Monitoring of Downstream Salmon and Steelhead at Federal Hydroelectric Facilities

Annual Report
2001

DOE/BP-00003992-1

February 2002

This Document should be cited as follows:

Martinson, Rick, Jeffrey Kamps, Gregory Kovalchuk, Dean Ballinger, ''Monitoring of Downstream Salmon and Steelhead at Federal Hydroelectric Facilities'', Project No. 1987-12700, 78 electronic pages, (BPA Report DOE/BP-00003992-1)

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

MONITORING OF DOWNSTREAM SALMON AND STEELHEAD AT FEDERAL HYDROELECTRIC FACILITIES
2001 Annual Report

Prepared By
Rick D. Martinson
Jeffrey W. Kamps
Gregory M. Kovalchuk
Dean Ballinger

Pacific States Marine Fisheries Commission
45 S.E. 82nd Drive, Suite 100
Gladstone, Oregon 97027-2522

Prepared For
Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, Oregon 97208

Project No. 1987-127-00
Contract No. 00003992

February 2002

TABLE OF CONTENTS

Abstract.— The 2001 river flows were the lowest in 30 years, which resulted in a delayed and reduced spill program. This affected juvenile salmonids in numerous ways, such as: delayed and longer migration periods, increased exposure to predators, increased turbine passage, and higher water temperatures. While all of these factors can be detrimental to fish condition, a corresponding decline in fish condition was not observed. Descaling was down for yearling chinook and steelhead and very close to the historically low levels set last year for subyearling chinook, and coho. Mortality was up slightly for nearly all species but was below 1% for all species. The biggest change for John Day was the reduction in the daily average sample rate (25% in 2000 to 2.4% in 2001) and the resulting reduction in number of fish handled (479,747 in 2000 to 98,895 in 2001). This reduction is due to the termination of the National Marine Fisheries Service study to evaluate The Dalles Dam spillway survival at different spill levels. The low flows delayed the 10% and 90% passage dates but did not significantly increase the migration duration of the middle 80% for most species. Coho were the exception with a group of fish passing the project in August, which generated a middle 80% duration of 90 days, which compares to a median duration of 26 days.

This was the second year of index level sampling at the Hamilton Island Juvenile Monitoring Facility. Operations were complicated by inconsistent dewatering at the primary dewatering structure, which could go from flooding to a dry screen in the same hour. Modifications to the flume between the primary and secondary dewatering structures, and the secondary dewatering structure itself, improved velocities and eliminated fish holding and debris accumulation in this area. About twice as many (100,457 vs. 54,051) fish were sampled this year as last year due mostly to increased research fish collection. The low river flows, reduced spill, and powerhouse 2 operational priority resulted in a doubling of the collection estimate (fish using bypass system) from 2.7 million last year to 5.6 million this year. Descaling was down from last year for all species except unclipped steelhead and down from the historical average for all species. Mortality rates, while below 1% for all species, did increase for all species. Low river flows also affected the timing of passage at Bonneville, delaying passage for all species.

Sampling in the first powerhouse was restricted to condition monitoring and gas bubble exams. In general fish condition was good, with slight increases in descaling for clipped steelhead and sockeye and reductions for other species. Mortality rates were very low, below 0.5% for all species. The low flows and powerhouse 2 operational priority reduced operation of powerhouse 1 to a daily average discharge of 6.3 kcfs, which reduced fish passage through that powerhouse. One result of this was a reduction in PIT tag detections from the flat plate system from 40,516 last year to 883 this year. This reduction is also due to the termination of a survival study at The Dalles Dam that used PIT tags. Of the 3,161 fish examined for gas bubble trauma, 1 fish, or 0.03% had symptoms.

PREFACE

Project 84-014 has been part of the annual integrated and coordinated Columbia River Basin Smolt Monitoring Program since 1984, and currently addresses measure 5.9A.1 of the 1994 Northwest Power Planning Council's (NPPC) Fish and Wildlife Program. The program is coordinated by the Fish Passage Center (FPC) and funded by the Bonneville Power Administration (BPA). The National Marine Fisheries Service (NMFS) established the project to: 1) collect and report daily fish capture, fish condition, dam operations, and river flow data to water managers to improve the scientific information on which to base in-season operations of the hydro system, and 2) analyze the collected data and characterize juvenile fish passage at main stem federal dams and transfer this information, learning, and understanding to the fisheries community through technical reports and publications. In the 1980s, NMFS conducted the smolt monitoring at Lower Granite, Lower Monumental, McNary, John Day, and Bonneville dams. Since the early 1990s, the smolt monitoring at the Snake River dams and McNary Dam was assumed by the states of Washington and Oregon, and this project (84-014) retained responsibility for monitoring at John Day, The Dalles (1989 - 1991), and Bonneville dams.

In 1999 the contract for project 84-014, which was the remaining federal portion of the Smolt Monitoring Program (SMP), was not renewed. The work previously done under this contract was combined with the non-federal portion of the SMP, project 87-127. This consolidation was done to facilitate review and reduce administrative costs.

The following report presents the results of the SMP activities at John Day and Bonneville dams this year as well as summaries of data for all years of the project at John Day and Bonneville dams.

INTRODUCTION

The seaward migration of juvenile salmonids was monitored by the Pacific States Marine Fisheries Commission (PSMFC) at John Day Dam, located at river mile 216, and at Bonneville Dam, located at river mile 145 on the Columbia River (Figure 1). The PSMFC Smolt Monitoring Project is part of a larger Smolt Monitoring Program (SMP) coordinated by the Fish Passage Center (FPC) for the Columbia Basin Fish and Wildlife Authority. This program is carried out under the auspices of the Northwest Power Planning Council's Fish and Wildlife Program and is funded by the Bonneville Power Administration.

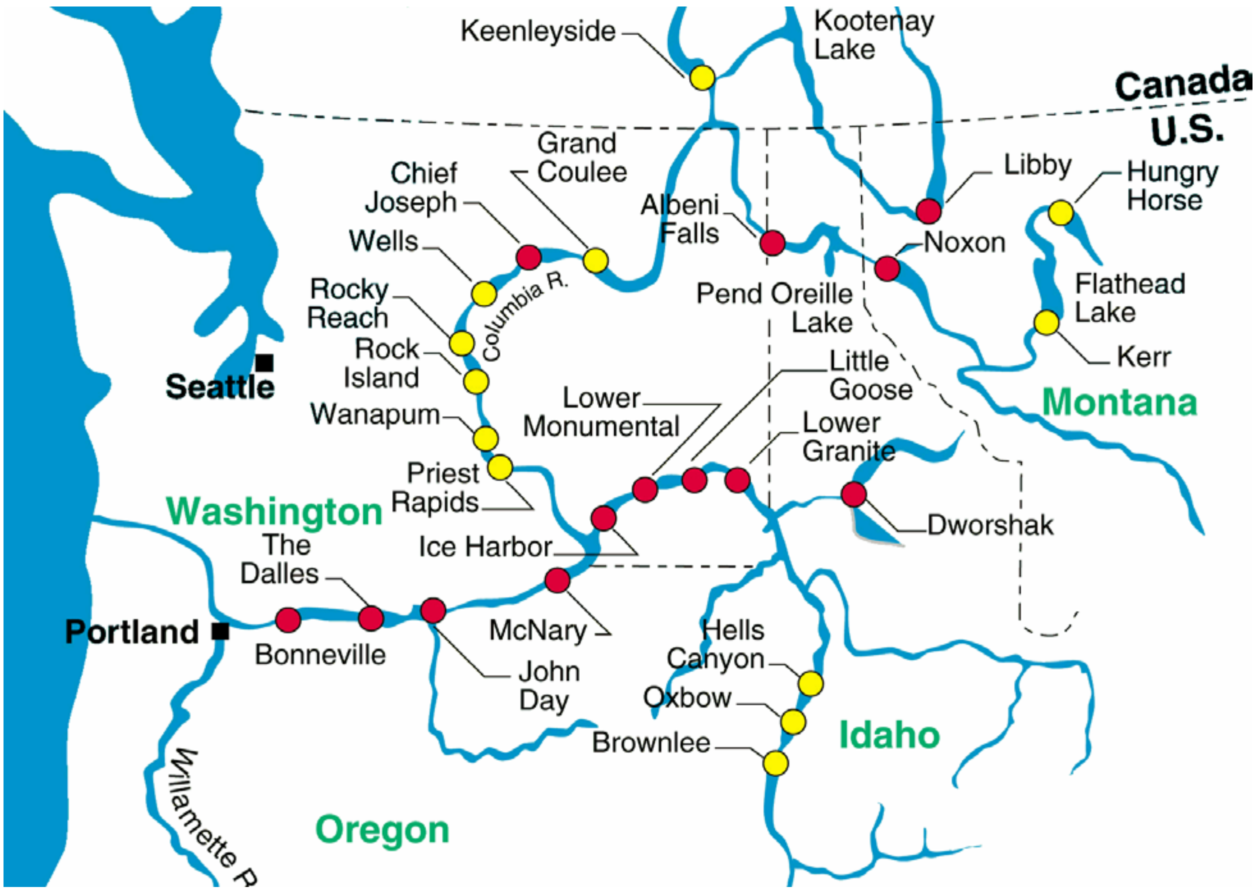


Figure 1. Hydroelectric projects on the Snake and Columbia Rivers. This figure is reprinted courtesy of the U.S. Army Corps of Engineers, Portland District.

The purpose of the SMP is to monitor the timing and magnitude of the juvenile salmonid out-migration in the Columbia Basin and make flow and spill recommendations designed to facilitate fish passage. Data are also used for travel time and survival estimates and to build a time series data set for future reference. The purpose of the PSMFC portion of the program is to provide the FPC with species and project specific real time data from John Day and Bonneville dams.

METHODS AND MATERIALS

JOHN DAY DAM

Sampling

John Day Dam is equipped with a juvenile bypass system (Figure C-10) consisting of Submersible Traveling Screens (STS's), gatewells, 14" orifices, and a tainter gate. As fish exit the bypass channel under the tainter gate, they are directed either back to the river or down the elevated chute toward the sampling facility, depending on the position of the crest gate. At the end of the elevated chute is the Primary Dewatering Structure (PDS). The PDS removes all but 30 cubic feet per second (cfs) of the roughly 450 cfs entering it. This remaining 30 cfs and all the fish travel down a corrugated flume equipped with a switch gate, which directs the flow to either the bypass (back to river) or sample (to sampling facility) flumes. In sample mode, the fish pass over the Secondary Dewatering Structure (SDS) where an additional 29 cfs are removed. The remaining water and fish exit the SDS and enter the large fish and debris separator (FDS), a group of parallel aluminum bars that allow the juveniles to pass through the bars while the adults and debris pass off the end and return to the river. Under the separator bars is a collection area known as the hopper, a sloped floor basket that directs the juveniles into the distribution flume leading to the PIT tag coils and rotating gates.

The 3-way rotating gate is used to obtain the general sample and research fish. When rotated to the west all fish are diverted into the sample tank, when rotated to the east all fish are routed to the research flume, and in the center or default position all fish go directly to the river. On the research flume is a 2-way rotating gate capable of selecting specific PIT tagged fish for diversion to a different tank, making it possible to collect fish for two different studies concurrently and hold them in separate tanks. This feature, together with the initial diversion at the 3-way gate, is referred to as the Separation by Code (SBC) system (Figure A-10).

The sample day began at 0700 hours and went to 0700 hours the next day. This is consistent with other smolt monitoring and transportation sites. Depending on the sample rate, 2 - 6 timed subsamples are collected each hour using the 3-way rotational gate. The sample rate range for smolt monitoring is 0.67% to 25%. When the sample rate is 20% or above, the system is put into Divert During Sample (DDS) mode. In this mode, if a PIT tagged fish passes through the system during sample collection, the 3-way gate rotates back to the center or bypass position, diverting the fish away from the sample. This feature is not used below 20 percent because it may remove too many fish from the sample and bias the data for that day. For a complete summary of sample rates, openings per hour, and other details, see Table 1. Sample rates above 25% are possible if needed for research fish collection.

During the spring migration, when species diversity is greatest, the target sample size range was 500 - 750 fish per day. During the summer migration, with mainly just subyearling chinook present, the target sample size range was 150 - 250 fish per day. Sample rates were adjusted as needed to achieve these target sample sizes.

Fish were processed at 1400 hours and 0700 hours daily and the results combined for a sample day total. Hourly processing at night was not necessary this year due to the termination of The Dalles spillway survival study. Fish collected at different sample rates were separated and expanded by their respective sample rates. Data collected at different sample rates are referred to as a subbatch. For a list of data collected, see Data Collected in the John Day and Bonneville section below.

Fish were collected in a 6,796 liter (1,795 gal) holding tank located inside of the sampling lab. At the end of a sample period, the crowder was moved forward and the next sample was collected behind it. New in 2001, when circumstances required holding more than two subbatches at a time, a removable panel was inserted to keep subbatches separate. Approximately 50 to 75 smolt were then crowded into a 20 by 24 inch pre-anesthetic (PA) chamber using a panel net. The water level in the PA chamber was lowered to about 8 inches (48 liters) and fish were anesthetized with MS-222 at a concentration of about 51 mg/l. Once anesthetized, fish were routed via a 6 inch PVC pipe onto a final dewatering screen and into the examination trough. MS-222 was added as needed to the examination trough to minimize stress during examination. A recirculating system was used to minimize MS-222 usage and a chiller kept examination trough water temperature consistent with river water temperature. An inline water filtration system was installed in 2000 to minimize the possibility of inadvertently culturing and spreading pathogens (viruses, bacteria, and fungus) in the recirculating examination water. Three Rainbow Plastics UV Sterilizer filters (40 watt), a Venturi Protein skimmer, and two sets of particulate bag filters (100 and 20 micron) were used in conjunction with the recirculation system. The bag filters were switched and cleaned daily or as needed. New electronic sample tally counters and a modified sorting trough were designed and installed in the lab for the 2001 season. Following examination, all sampled fish were routed via a 4 inch PVC pipe to a 2,726 liter (720 gal) recovery tank and held for a minimum of 25 minutes before being returned to the bypass system. A digital timer was used to facilitate correct recovery times. This process was repeated until the entire sample had been examined. All holding and recovery tanks had a constant exchange of river water. Diagrams showing the schematic of the lab and the footprint of the facility are presented in Figures A-10 and A-11, respectively.

BONNEVILLE DAM
Sampling - Second Powerhouse

The second powerhouse at Bonneville is equipped with a juvenile bypass system (Figure C-10) consisting of Submersible Traveling Screens (STS's), gatewells, 12" orifices, and vertical wall screens that remove all but 30 cfs of the roughly 340 cfs in the bypass channel. At the end of the screened section is the entrance to the 1.7-mile conveyance pipe that leads to the Hamilton Island Juvenile Monitoring Facility (JMF). A switchgate at the exit of the pipe directs the flow to either the sampling facility or directly back to the river. In the sample position, the 30 cfs in the flume flows into the Primary Dewatering Structure (PDS) where it is reduced to about 0.5 - 1 cfs that empties onto the FDS (see description in John Day section above). As fish exit the hopper area under the separator bars, they travel down a flume toward the first set of PIT tag coils. These coils can be used to activate the 3-way rotational gate to divert fish with specific PIT tag codes into one of two holding tanks in the basement of the facility. This is the Separation by Code (SBC) system. Just downstream of the 3-way rotational gate on the default or center flume is the 2-way rotational gate. The 2-way gate is used exclusively to collect timed subsamples for smolt monitoring. Collected fish are routed to an 18,930 liter (5,000 gallon) holding tank in the basement. This system differs from John Day where the 3-way gate is used for initial SBC and SMP sample collection and the 2-way gate, which is on the SBC flume, is used for subdivision of SBC fish.

The sample day began at 0700 hours and went to 0700 hours on the next day. Depending on the sample rate, 2 - 6 timed subsamples are collected each hour using the 2-way rotational gate. The sample rate range for smolt monitoring is 0.67% to 25%. When the sample rate is 20% or above, the system is put into Divert During Sample (DDS) mode (see explanation in John Day section). For a complete summary of sample rates, openings per hour, and other details, see Table 1. Sample rates above 25% are possible if needed for research fish collection.

During the spring migration, when species diversity is greatest, the target sample size was 500 - 750 fish per day. During the summer migration, with mainly subyearling chinook present, the target sample size was 150 - 250 fish per day. Sample rates were adjusted as needed to achieve these target sample sizes.

All of the holding tanks are equipped with crowders used to separate fish collected on one sample day from the next, or fish collected at different sample rates. Fish collected at different sample rates are processed separately. The crowders are also used to crowd fish to the fish lift end of the holding tanks. Because the JMF is 1.7 miles from the powerhouse, head loss made it necessary to put the holding tanks in the basement of the JMF. The processing area is on the main floor so fish lifts, or fish elevators, are used to transport the fish upstairs. The fish lifts, which measure 24 by 27 inches, also function as pre-anesthetizing (PA) chambers. Approximately 50 to 75 smolt were crowded into the PA chamber, water was lowered to about 10 inches (104 liters), and fish were anesthetized with MS-222 at a concentration of about 51 mg/l. When the fish were partially anesthetized, the fish lift was hoisted to the main floor. From there, fish traveled through a 20 foot piece of 6 inch PVC pipe which lead to the sorting trough. Fish passed through a final dewatering device before arriving in the examination trough. MS-222 was added to the examination trough as needed to minimize stress during examination. Following examination, fish were routed via a 4 inch PVC pipe to a recovery tank and held for a minimum of thirty minutes before being released. Upon release, fish pass through one more set of PIT tag coils before returning to the bypass flume. Downstream of where they enter the bypass flume is another switch gate that directs the flow to either the high water or low water outfall. The system switches from one outfall to the other when the river elevation at the outfall is around 17 feet.

Powerhouse 2 (PH2) diagrams showing the footprint of the facility and the schematic of the lab are presented in Figures B-8 and B-9, respectively. Please see Krcma et al. (1984) for a description of the system used prior to 1997. For a description of the system used in 1997 and 1998 see Martinson, et al. (1998) and for diagrams of the system see Figure B-10 and B-11. Figure B-7 shows the fish processing area of PH2 used through 1998.

First Powerhouse

The first powerhouse (PH1) is equipped with a bypass system very similar to that of the second powerhouse (Figure C-10), in that it consists of STS's, gatewells, and orifices. At the end of the bypass channel, the dewatering is done with a floor screen instead of wall screens. At the end of the screened section, the fish and remaining water plunge into an area called the downwell, which leads to the tailrace. The 2,415 liter (638 gal) tank used to collect samples is positioned over the downwell and the water and fish are directed into it with a small movable screen section. For further explanation see Gessel et al. (1986) and for a cross sectional diagram see Figure C-8.

Sampling occurred between 1600 and 2400 hours on Monday and Thursday for condition monitoring and Gas Bubble Trauma (GBT) exams. On Saturdays, only condition monitoring was conducted. Research fish collection occurred on various days. The sampling effort was adjusted from 30 seconds to 15 minutes per set, depending upon passage numbers and run timing. Typically, 15 to 25 fish per set were optimal for condition and GBT monitoring, while 50 to 100 fish per set were targeted for research fish collection. Collected fish were routed from the tank to a holding tank via a rectangular chute. From there, about 30 to 60 fish were crowded into a PA chamber and anesthetized with MS-222 at a concentration of about 51 mg/l. Once anesthetized, fish were net transferred from the holding tank to the examination trough. MS-222 is added to the examination trough as needed to minimize stress during examination. After processing, sampled fish were scanned for PIT tags before going to a recovery tank. Fish were allowed to recover for at least 30 minutes before being released into the downwell via a 6 inch PVC pipe.

Flat Plate Operation

PIT tag detections in PH1 are collected using a system that was retrofit onto the top of the sample collection basket, and commonly referred to as the flat plate system. It was installed in 1996 to provide full bypass channel detection capability for a NMFS research project. More conventional PIT tag systems consist of a tunnel that the PIT tagged fish passes through to be detected while fish pass over the flat plate system to be detected. In 2000, the system was converted from 400 kHz to 134.2 kHz, which is the international standard. The 134.2 kHz system provides better read rates and ranges.

The flat plate is fitted with pneumatic cylinders which can raise the flat plate and allow sample fish to enter the collection basket. Between samples, the flat plate was lowered onto the trap and the trap returned to sampling position. As fish pass over the flat plate, they are scanned for PIT tags. Flat plate efficiency is mostly affected by water depth on the flat plate and orientation of the fish.

Gas Bubble Trauma (GBT) Subsampling

In 2001, the number of fish examined each session went from 200 to 100, and they could be a combination of chinook and steelhead. Samples were collected twice weekly, usually on Mondays and Thursdays. Exams focused on unpaired fins, eyes, and the lateral line using a variable power, dissecting microscope (6X to 40X). Bubbles were quantified as the “percent of the lateral line occluded” or, on fins and eyes, “percent area of the fin covered” and assigned a severity ranking (Fish Passage Manager, 1999, p33). If occlusion was less than 5%, a rank of 1 was assigned. A rank of 2 was used for 6% - 25%, rank 3 for 26% - 50%, and a rank of 4 for greater than 50%. Results were summarized, recorded, and transmitted to the FPC.

JOHN DAY AND BONNEVILLE

Subsampled Fish Condition

Detailed fish condition monitoring targeted a sample size of 100 individuals per species, approximately three days per week. The sampling crew attempted to choose fish at random and to select fish throughout the sample day. Steelhead and sockeye were examined Tuesday, Thursday, and Saturday, whereas yearling chinook and coho were examined Monday, Wednesday, and Friday. Subyearling chinook were examined every day of the week when present. In addition to fin clips, tags, and brands, smolts were examined for descaling, injuries to the head and body, parasites, disease, and signs of predation. Fork lengths were also recorded.

Performance Monitoring

Tests and digital imaging were used to evaluate species identification, brand recognition, descaling assessment, and data recording accuracy of SMP personnel during 2001. During tests, a subsample of ten fish were randomly selected, anesthetized, and placed into a compartmentalized divider located in the sorting trough. Fish were processed independently and specific details were recorded for each fish including: 1) species, 2) fin clip, 3) level of descaling, and 4) presence of external marks or tags. Coworkers then compared and discussed results. The benefits of this method include: 1) increased frequency of tests, 2) several people are able to test concurrently, 3) promotes teamwork and builds consistency between coworkers, and most importantly, 4) the ability to discuss discrepancies with fish in hand. Photographs were valuable for documenting unknowns, discrepancies, and oddities, which could be examined later with no risk to the fish.

Data Collected
The following is a list of data collected daily and either manually sent to FPC or automatically uploaded to the Columbia Basin PIT Tag Information System.

1) Species specific subbatch and daily sample totals
2) Brands, tags, fin clips, and PIT tag detections
3) Descaling and mortality
4) Species specific length and condition data (subsampling only)
5) River, powerhouse, turbine, and spill flow data

DEFINITION OF TERMS

Three types of numbers are discussed in the report, defined as follows:

1) Total Sample: actual fish counts, number of fish handled.

2) Estimated Collection: total sample number divided by sample rate, resulting in an estimated number of fish passing through collection system.

3) Fish Passage Indices: estimated collection counts divided by the proportion of total river flow passing through the sample system resulting in a relative indicator of fish abundance with no adjustment for Fish Guidance Efficiency, horizontal, vertical or temporal fish distribution.

As stated in the Fish Passage Center annual reports, Fish Passage Indices (FPI) are used as relative indicators of population abundance, and assumes that fish pass through spill and powerhouse units in numbers proportional to the flow through those passage routes. Indices are not estimates of total daily passage, but rather a relative measure of how the migration is progressing over the season for a given species.

In previous reports, two types of FPI's were presented, an Hourly and a Daily. Hourly FPI's differed from Daily FPI's in that an index value was calculated for each hour and 24 hours were added for a daily total. They generated an index estimate that was nearly identical to the Daily index so in this report, all Hourly FPI's have been eliminated. This report and all future reports will refer to the Daily FPI as the Fish Passage Index (FPI).

The following table is used to approximate the correct sample rate for a given level of fish passage.

Table 1. Sample rate reference chart for John Day and Bonneville dams.

Estimated Daily Collection	Sample Rate (%)	Estimated Number of Fish in Sample	Equivalent Multiplier 1/Sample Rate	Sample Sec/ Hour	Subsamples per Hour	Subsample Duration in Seconds
>80,000	0.67%	>536	150	24	2	12
75,000 - 80,000	0.83%	623 - 664	120	30	2	15
60,000 -74,999	1.00%	498 - 750	100	36	3	12
40,000 - 59,999	1.33%	332 - 780	75	48	4	12
25,000 - 39,999	2.00%	500 - 800	50	72	6	12
15,000 - 24,999	3.33%	500 - 833	30	120	6	20
13,000 - 14,999	4.00%	520 - 600	25	144	6	24
10,000 - 12,999	5.00%	500 - 650	20	180	6	30
8,000 - 9,999	6.67%	533 - 667	15	240	6	40
7,000 - 7,999	8.33%	583 - 667	12	300	6	50
6,000 - 6,999	10.00%	600 - 700	10	360	6	60
5,000 - 5,999	11.11%	556 - 667	9	400	6	66.7
4,000 - 4,999	12.50%	500 - 625	8	450	6	75
3,000 - 3,999	16.67%	500 - 667	6	600	6	100
2,500 - 2,999	20.00%	500 - 600	5	700	6	116.7
1,500 - 2,499	25.00%	375 - 625	4	900	6	150
1,000 - 1,499	33.33%	333 - 500	3	1200	6	200
300 - 999	50.00%	150 - 500	2	1800	6	300
<299	100.00%	<299	1	3600	1	3600

RESULTS AND DISCUSSIONS

JOHN DAY DAM

In 2001, the fourth year of sampling in the Smolt Monitoring Facility (SMF) at John Day Dam, sampling commenced on 30 March and ended on 17 September. See Table A-1 for a summary of all years of sampling, including sample dates, sampling effort, sample, collection, and index numbers. To see a diagram of the airlift system, used from 1985 - 1997, see Figure A-12. For a description of the airlift system, see Martinson, et al. (1997) or before.

The Numbers

Sample Numbers

The total number of fish handled at John Day in 2001 was 98,895 (Table 1), about 20.6% of the 2000 total of 479,747. Reduced research fish collection is responsible for the large decline. The average sample rate in 2000 was 25% but in 2001, it was only 2.4%. Species specific sample numbers expressed as a percent of 2000 sample numbers are as follows: clipped sockeye, 35.1%; yearling chinook, 33.4%; subyearling chinook, 20.4%; unclipped sockeye, 17.3%; unclipped steelhead, 17%; clipped steelhead, 8.8%; and coho, 5.3%. See Table 1 for the actual numbers and Table A-1 for a comparison to previous years.

The species composition, expressed as a percent of all the fish sampled, was higher this year than last year only for yearling chinook, 42.1% versus 26%. It was lower for coho, 3.1% versus 12%; clipped steelhead, 3.4% versus 8%; unclipped steelhead, 7.7% versus 9.3%; about the same for subyearling chinook, 40.7% versus 41.1%; unclipped sockeye, 2.9% versus 3.5%; and clipped sockeye at 0.1% both years.

Collection Estimates

The total collection estimate of 4,152,457 is about 181% of the 2000 collection estimate of 2,296,519, however, not all species showed an increase in their collection estimates. Collection estimates expressed as a percent of last year's estimate are as follows: clipped sockeye, 384%; subyearling chinook, 251%; unclipped sockeye, 230%; yearling chinook, 163%; unclipped steelhead, 66%; coho, 46%; and clipped steelhead, 35%. Since the collection number represents the estimated number of fish passing through the bypass system, and that number is going to be much higher if there is no spill, it is reasonable for this estimate to be elevated this year. Except for the 3 week period between 25 May and 16 June, when some spill occurred at John Day Dam, fish arriving at the project had only two passage routes, through the bypass system or through the turbines.

Fish Passage Indices

Collection numbers are divided by the proportion of river flow through the sample unit to get a Fish Passage Index (FPI). The 2001 index total for all species combined was 4,232,594, about 126% of the 2000 FPI of 3,353,359. The fact that the collection estimate and fish passage index are nearly the same is another product of the low flow year. Since there was very little spill, nearly all river flow went through the sample unit (powerhouse) resulting in very little expansion of the collection estimate. A breakdown by species for sample, collection, and index numbers can be found in Table 1 and a comparison of 2001 numbers to all previous years can be found in Table A-1. For more information on collection and index estimates see the Fish Passage Center annual report.

Fry Incidence

The number of chinook fry ($\leq$ 60mm) collected this season was 1,352. This is approximately 21% of the 6,555 collected in 2000, only 19% of the 7,012 collected in 1999, and 32% of the 4,229 collected in 1998. In 2001, 5.6% of the fry were collected in April, 88.8% were collected in May, and 5.5% in June (Figure 3). See Table A-1 for a summary of chinook fry collection estimates since 1987.

Table 2. Summary of 2001 smolt monitoring at John Day and Bonneville dams.

Species	Site	Sample Number	Sample Percent Comp.	Collection[1] Number	Collection[1] Percent Comp.	FPI[2]	Descaling[3] #	Descaling[3] %	Mortality[4] #	Mortality[4] %
Yearling Chinook	John Day	41,659	42.1	948,154	22.8	1,006,079	685	1.7	300	0.72
	Bonneville PH #1	1,164	19.6				15	1.3	2	0.17
	Bonneville PH #2	21,304	19.5	1,320,763	23.6	1,687,846	384	1.8	236	1.11
Subyearling Chinook	John Day	40,215	40.7	2,840,619	68.4	2,849,767	355	0.9	189	0.47
	Bonneville PH #1	4,245	71.6				10	0.2	7	0.16
	Bonneville PH #2	57,213	52.3	2,348,968	41.9	2,940,643	322	0.6	299	0.52
Unclipped Steelhead	John Day	7,567	7.7	123,614	3.0	124,829	109	1.4	3	0.04
	Bonneville PH #1	91	1.5				0	0.0	0	-
	Bonneville PH #2	2,672	2.4	167,593	3.0	223,406	53	2.0	22	0.82
Clipped Steelhead	John Day	3,394	3.4	64,287	1.5	66,302	159	4.7	20	0.59
	Bonneville PH #1	25	0.4				3	12.5	1	4.00
	Bonneville PH #2	3,023	2.8	198,581	3.5	265,991	140	4.7	16	0.53
Coho	John Day	3,037	3.1	79,576	1.9	81,644	49	1.6	11	0.36
	Bonneville PH #1	397	6.7				1	0.3	1	0.25
	Bonneville PH #2	24,084	22.0	1,496,057	26.7	2,164,025	176	0.7	348	1.44
Unclipped Sockeye	John Day	2,881	2.9	91,863	2.2	99,355	199	6.9	9	0.31
	Bonneville PH #1	9	0.2				2	22.2	0	-
	Bonneville PH #2	1,102	1.0	71,287	1.3		90	8.2	10	0.91
Clipped Sockeye	John Day	142	0.1	4,344	0.1	4,618	4	2.9	5	3.52
	Bonneville PH #1	-	0.0				0	0.0	0	-
	Bonneville PH #2	59	0.1	3,666	0.1	5393	2	3.4	1	1.69
SEASON TOTALS	John Day	98,895		4,152,457		4,232,594	1,560	1.6	537	0.54
	Bonneville PH #1	5,931					31		11	0.19
	Bonneville PH #2	109,457		5,606,915		7,388,877	1,167		932	0.85

[1] Collection numbers are sample numbers divided by sample rate.
[2] FPI (Fish Passage Index) is collection divided by the proportion of daily average river flow through the powerhouse.
[3] Descaling numbers are based on sample numbers minus mortality numbers.
[4] Mortality numbers are based on sample numbers.

River Conditions

River Flow

Throughout the juvenile out-migration, river flow was significantly lower in 2001 than in 2000. The 2001 spring (April and May) river flow averaged 123.0 kcfs, only 45.8% of the 268.6 kcfs for the same period last year. The spring peak flow of 165.6 kcfs occurred on 30 May and was 196 kcfs smaller than last years 24 April peak of 361.9 kcfs. For the summer migration period, June and July, the average river flow of 107.2 kcfs was about 78.6 kcfs less than the average for the same period last year. Late summer flows continued to decline averaging 89.5 kcfs from 1 August through the end of the season (17 September) compared to an average of 130.5 kcfs last year (Figure 3).

Spill and Dissolved Gas

The Fish Passage Plan calls for spill to be 60% of river flow from 10 April to 31 August when total river flow is less than 300 kcfs, excluding special conditions for research. This year, spill during that period averaged just 1.9% of total river flow. Last year for the same period, spill averaged 32% of river flow. Due to extremely low river flows, spill was only provided for about three weeks this year, from 25 May to 15 June. For this period, spill averaged just 13.1% of river flow.

For April and May, percent gas saturation in the John Day tailrace averaged 104.5% and peaked at 110.5% on 25

May. This compares to an average of 114.6% last year. The average for the period when spill occurred this year, 25 May through 15 June, was 105.6%. The atypical levels of spill enabled the total dissolved gas limits imposed by the Washington and Oregon water quality departments to generally be maintained. For more detail on dissolved gas levels and monitoring results, see the Fish Passage Center annual report.

Temperature

Spring water temperature in the fish handling facility ranged from 46.3^{0}F to 61.6^{0}F and averaged 52.6^{0}F, which was 0.7^{0}F cooler than last year's average of 53.3^{0}F for the same period. During June and July the range was 60.8^{0}F to 69.7^{0}F with an average of 65.1^{0}F, which was 0.3^{0}F warmer than the same period last year. In August and September, the range was 68.4^{0}F to 73.5^{0}F, with an average of 70.8^{0}F, which was 1.5^{0}F warmer than the same period last year. The highest temperature of the year was recorded on 18 August.

Passage Patterns

The low river flows in 2001 delayed the juvenile out-migration past John Day Dam. Some species were affected more than others but on average, 10% passage dates were 11 days later and 90% passage dates were 24 days later than their respective historical median dates. Fish Passage Indices are used to summarize passage.

Yearling chinook passage was about two weeks later than last year, with the 10% and 50% dates this year occurring just a few days before the 50% and 90% dates last year, respectively (Figure 2).
The 10% passage date was the second latest ever recorded, tied with 1993 and just three days behind the latest date recorded back in 1985 (Table A-2, Figure A-2). The 90% date of 20 June is the latest date on record and resulted in the second longest duration (46 days) for the middle 80% of the migration.

Significant passage began in early May and continued well into June. Daily percent of total passage increased to about 2% on 1 May and stayed between 1% and 6% through mid-June. One notable exception occurred 2 days after spill began on 25 May when passage dropped to less than 1% of total index (Figure 3).
Passage peaked at 5.9% of total on 2 June (Figure 3). The shift in the passage timing is evident when compared to the historical passage graph (Figure A-1).

The subyearling chinook passage pattern was similar to the yearling chinook pattern with the 10% and 50% dates this year occurring just a few days before the 50% and 90% dates recorded last year, respectively (Figure 2). Overall, the subyearling chinook migration reached the 10% and 90% dates almost three weeks later than last year's 10% and 90% dates, but the duration of the middle 80% differed by only two days. Further evidence of the delayed migration is evident when compared to the median. Subyearlings started moving two weeks later but reached the 90% point one week later, resulting in a middle 80% duration 9 days longer (Figure 2, Table A-2). Daily fluctuation in passage estimates were small compared to other species. Only one day (8/10 - 3.9%) exceeded 3% of total seasonal passage (Figure 3, Figure A-1).

Unclipped steelhead passage seemed to be affected less by the low flows this year, with a passage pattern more like previous years than other species. Passage reached the 10% point ten days later than last year but reached the 90% point about the same time as last year, resulting in a duration for the middle 80% of 33 days, 8 days shorter than the middle 80% for 2000. Compared to the median, the timing and duration were nearly identical (Figure 2, Figure A-2). A large spike of 18% on 1 May dominated the passage pattern (Figure 3). For the rest of the season the daily percent of total did not exceed 5%. With the exception of the one large passage spike, the timing, duration, and pattern are similar to the historical average passage pattern shown in Figure A-1.

Clipped steelhead passage timing was similar to other species, reaching the 10% and 90% passage dates about two weeks later than last year. Compared to the historical median, this year's run started about the same time but lasted longer, resulting in a middle 80% duration 16 days longer (Figure 2, Figure A-2). Overall, the time taken by the middle 80% of the clipped steelhead run seems to be increasing at John Day Dam. For the last three years, it has taken 40 days. For the 5 years prior to that (1994-1998) it took 26.6 days and for the years 1990 - 1993, it took 22 days (Figure A-2). As with the unclipped steelhead, the passage pattern for clipped steelhead was dominated by one large peak on 12 May of 8.8% of season total. Daily fluctuations before and after that spike did not exceed 5% (Figure 3). This year's passage pattern was quite different from the historical average passage pattern in that there were larger than normal spikes at the beginning and end of the run but below average passage when it is usually highest, the last half of May (Figure A-1).

Coho passage showed more deviation in timing and duration than any other species. Compared to last year, coho were 12 days later reaching the 10% passage date and 36 days later reaching the 90% date (Figure 2). The extremely late 90% date was due to an uncharacteristic passage spike in mid-August that coincided with an increase in river flow (Figure 3). The net effect of this late season passage was a new record (90 days) for the middle 80% duration of the coho run, more than twice the previous record (41 days) and more than three times the historical median of 26 days (Figure 2, Figure A-2). The coho passage pattern was marked by two large spikes that coincided with spill, the first was 10.5% of the total index on 23 May and the second was 9.9% on 1 June. There were also a couple of smaller spikes in mid-June and then the mid-August passage, which peaked at about 4% of the season total (Figure 3). Coho passage has historically shown a lot of variation in daily passage magnitude, evident in the consistently long standard deviation lines over the coarse of the migration (Figure A-1).

Sockeye passage was also delayed this year with the 10% date occurring just a few days before the 90% date for both last year and the historical median (Figure 2). The 10%, 50%, and 90% passage dates this year were the latest ever recorded for sockeye (Table A-2). As with the other species, the sockeye out-migration was delayed by the low flows. However, the duration of the migration, or the time required for the middle 80% of the run to pass John Day Dam (27 days), was nearly identical to the historical median (26 days), and two weeks shorter than last year (41days). Sockeye began showing up in the samples about 20 May and had four significant passage spikes in June, much later than previous years (Figure A-1). The passage spikes were significant, nearly at or above 9% on 3 of the 4 occasions (Figure 3).

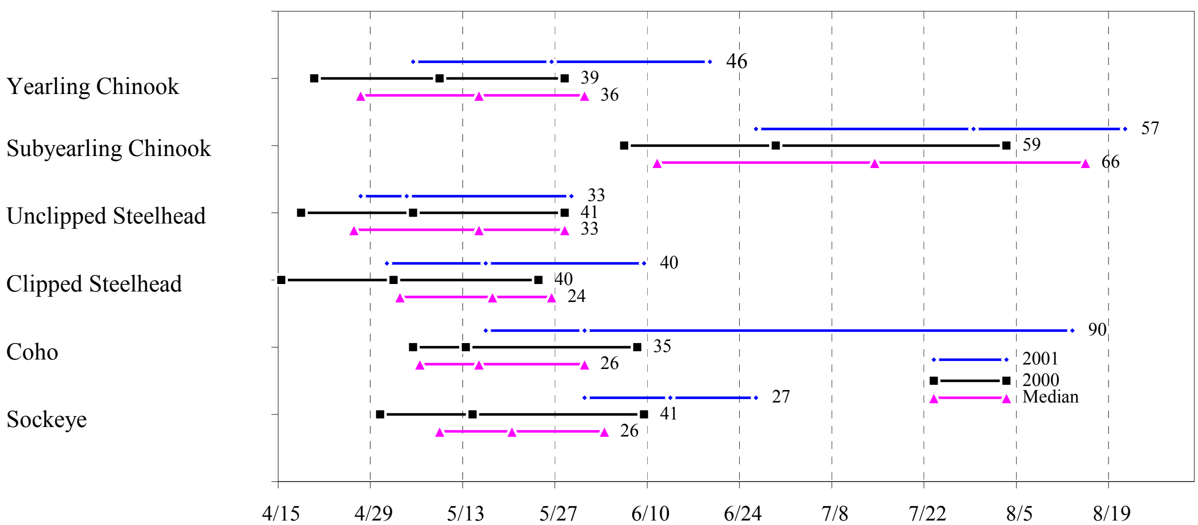


Figure 2. 10%, 50%, and 90% passage dates at John Day for 2001, 2000, and the historical median. The duration (in days) between the 10% and 90% passage dates is indicated for each line.

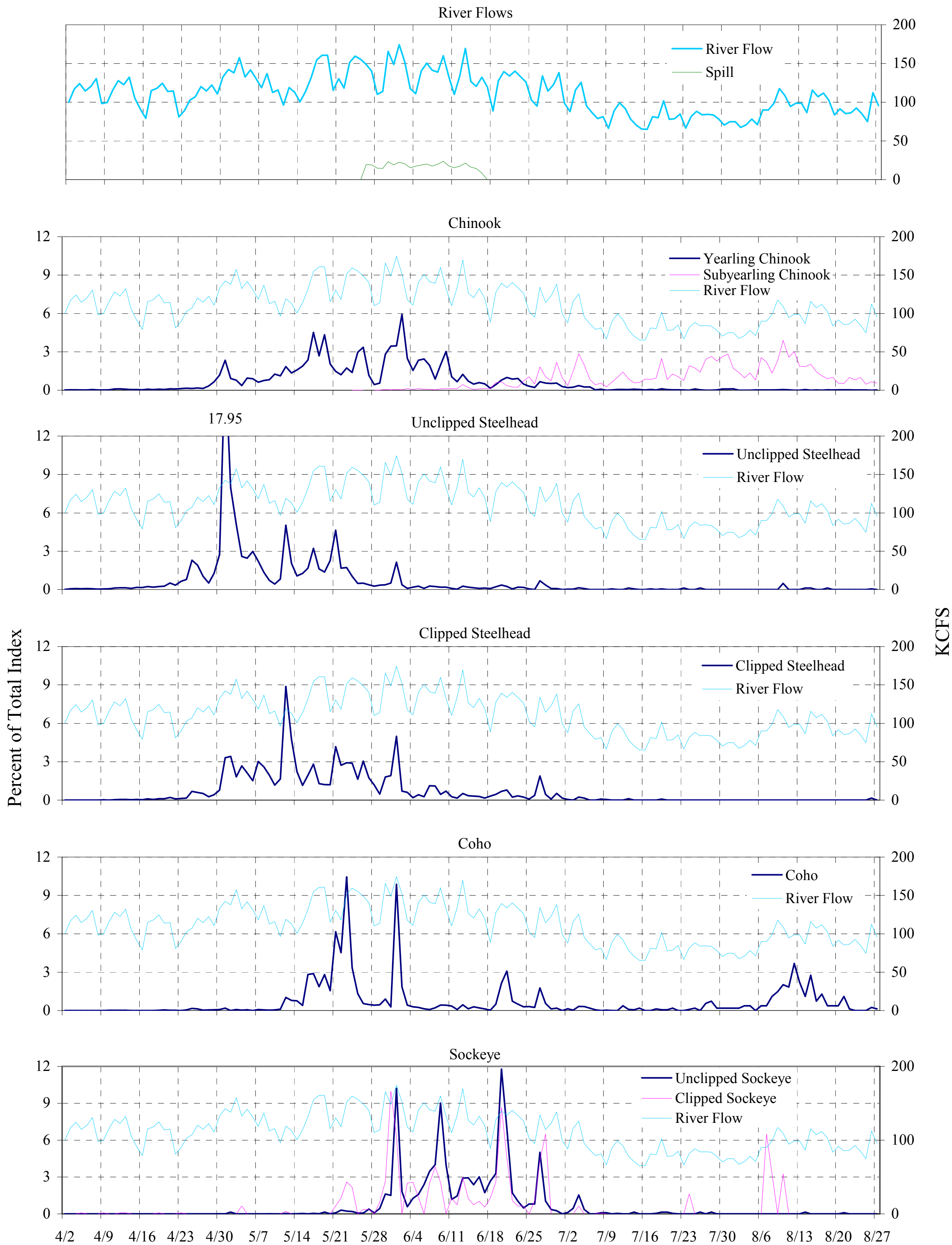


Figure 3. Seasonal passage patterns and daily average river flows for John Day, 2001.

Diel
With the relocation of sampling to the new SMF in 1998, the collection of the hourly passage detail was discontinued. However, the diel data collected between 1985 and 1997 is presented several ways in Appendix A. Table A-12 presents the total percent of night passage by species for each year. Figure A-8 is a graphical presentation of the diel pattern for all years, averaged and presented with standard deviation for each hour. Figure A-9 shows the percent of night passage as a bar graph for each year and species, with the average for each species shown as a line. Table A-11 shows the detail for each hour, for all years of sampling, by species.

Fish Condition
Overall, descaling at John Day Dam in 2001 was very low for all species (Figure 4). Flows and corresponding debris loads were low to moderate all season and overall fish condition was excellent.

Yearling chinook descaling, at 1.7%, was the lowest ever recorded for that species (Table A-3). It is less than half the rate of the last two years and less than a third of the 1985 - 1997 average (Figure 4, Table A-3, Figure A-4) when samples were collected with the airlift pump system (see Methods section). Descaling was highest during the first half of April, with two peaks of 6% and 4%. Over the rest of the season, descaling fluctuated around 2%, generating the 1.7% rate for the season (Figure A-3).

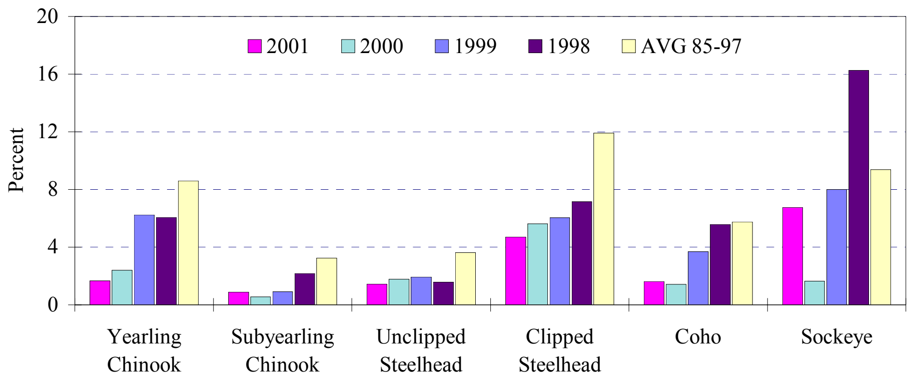


Figure 4. Total descaling for 2001, compared to 2000, 1999, 1998 and the 85-97 average (gatewell sampling) at John Day.

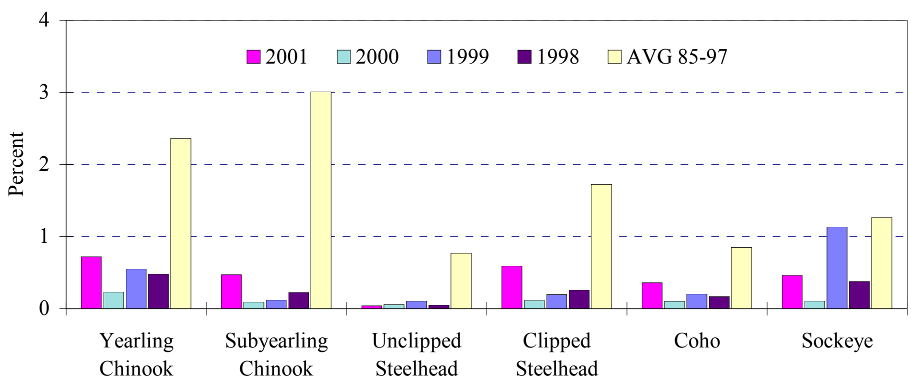


Figure 5. Total mortality for 2001, compared to 2000, 1999, 1998 and the 85-97 average (gatewell sampling) at John Day.

Mortality for yearling chinook was up to 0.7%, higher than the 3 previous years of sampling in the SMF, but still only about one third the rate observed in the 1985-1997 airlift samples (Figure 5, Figure A-5, Table A-3).

Subyearling chinook descaling has declined steadily since 1998 (Figure 4) but was up to 0.9% from a record low of 0.6% in 2000 (Table A-3, Figure A-3). Daily descaling increased as the season progressed, not exceeding 2% until the end of July but frequently reaching or exceeding 2% in August and September (Figure A-3). Mortality for subyearlings was up to 0.5% this year after a record low last year of just 0.1%. This is still a fraction of the 3%

average for the years prior to 1998 when fish were collected using the airlift system (Figure A-5, Table A-3).

Unclipped steelhead descaling was down from 1.8% last year to 1.4% this year. This rate is less than half the 3.6% rate for the years prior to 1998 (Figure 4). Daily descaling peaked at about 4% in mid-April and again in mid-May (Figure A-3). Mortality rates for unclipped steelhead continue to be very low with only 3 mortalities out of 7,567 fish sampled. Since 1997, the overall mortality rate has been 0.1%, compared to the 0.8% established in the airlift sampling years, 1985-1997 (Figure A-5, Table A-3).

Clipped steelhead descaling continued the downward trend started in 1997, going from 5.6% last year to 4.7% this year (Figure 4, Table A-3). Clipped steelhead descaling fluctuated between 0% and 6% regularly over the course of their migration, peaking at 11.6% in mid-May. Again, as with the other species, descaling has declined since abandoning the airlift system, going from an average of 11.9% prior to 1998, to 5.9% since (Figure A-5, Table A-3). Mortality rates exhibited a similar pattern, averaging 1.7% prior to 1998 and just 0.3% since (Figure 5). Mortality increased from 0.1% last year to 0.6% this year.

Coho descaling averaged 1.5% for the season, up slightly from the record low of 1.4% set last year (Table A-3). The average since 1998 is about 3%, about half the 1985 - 1997 average of 5.8% (Figure A-4, Table A-3). Daily rates exceeded 3% only twice; on 26 May descaling went to almost 10% and on 19 June it went to almost 6% (Figure A-3). Mortality, while up slightly from last year, was still quite low at 0.4% (Figure A-5, Table A-3).

Sockeye descaling, after 4 years of steady decline and setting a new record low in 2000 (1.6%), was up to 6.7% this year (Table A-3). Daily descaling fluctuated a great deal, going from 0% to the season high of almost 18% in the same week on 1 June (Figure A-3). Mortality was up from 0.1% last year to 0.5% this year, considerably less than the historical average (Figure A-5, Table A-3).

Subsampled Fish Condition

In 2001, 17,720 smolts were examined for detailed condition information. Partial descaling (3-19% on one side) increased for subyearling chinook, from 2.8% last year to 8.2% this year. Sockeye went from a record low of 6.9% last year to 15.7% this year. The amount of decrease for the other species ranged from 1.1% to 5.3%. Sockeye also had the highest incidence of operculum damage at 0.6%, which is 0.2% lower than last year. Again, as in past years, the incidence of attempted bird predation was much higher on clipped steelhead (7.3%) than any other species (0.1% - 2%). Fungus on clipped steelhead increased from 0.9% to 2.4%. The frequency of body injury was 0.9% to 2.2% lower for all species, except sockeye, which increased from 0.9% to 1.3%. Clipped steelhead had the highest incidence at 2.2%, but was down from 3.1% observed in 2000. The incidence of parasites on unclipped steelhead increased from 2.5% in 2000 to 8.2% in 2001. Columnaris infection in coho increased slightly from 0% last year to 0.3% this year. See Methods section for a complete list of possible conditions and techniques. For a historical summary of condition subsampling results, see Table A-4.

Condition data were collected on yearling chinook from 31 March to 8 July, steelhead from 31 March to 9 June, coho from 10 April to 10 June, sockeye from 12 June to 5 July, and subyearling chinook from 6 June to 17 September.

Length Averages

Since high percentages of out-migrating smolts are of hatchery origin, length data are primarily a function of smolt size at the time of release. However, graphing the data does show some relative size differences and trends throughout the season. Clipped steelhead were consistently the largest fish sampled until 9 June, when subsampling for clipped steelhead stopped. Subyearling chinook and sockeye increased in size as the season progressed and all other species varied (Figure 6).

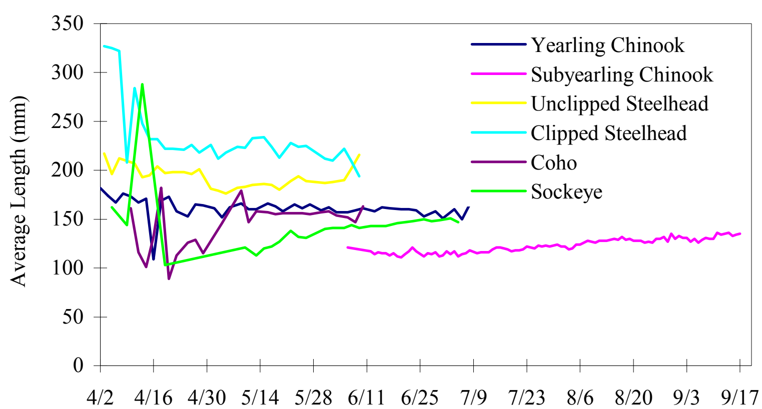


Figure 6. Average lengths at John Day in 2001.

Gas Bubble Trauma (GBT) Monitoring
Sampling of juvenile salmonids for GBT was discontinued at John Day in 1999. For results in 1998 and previous years, see the reports for those years or the Fish Passage Center website (www.fpc.org).

Passive Integrated Transponder (PIT) Tags and External Marks
PIT Tags
Total PIT tag detections increased from 41,848 in 2000 to 80,282 in 2001, a 192% increase. This increase in detections is similar to the increase in the collection estimate (2,296,519 in 2000 to 4,152,457 in 2001) and consequently the proportion of PIT tagged fish was about the same, 1.8% in 2000 and 1.9% in 2001. Chinook (96.9%) and steelhead (2.1%) accounted for 99% of all detections while coho and sockeye made up the remaining 1%. About 0.4% of the detections were from "holdovers", or fish that were scheduled to migrate in 2000. A summary for this year by species, run, rearing type, and scheduled migration year can be found in Table A-5. Refer to Table A-6 for a historical comparison of PIT tag detections at John Day.

Elastomer Tags
Elastomer tags are made of colored plastic that is injected into tissue posterior of the eye. A total of 1,919 elastomer tags were recorded this year, which is about 25.7% of the number observed in 2000 (Table A-8). This is due to the reduction in sample numbers due to a decline in research fish collection. However, the proportion of sampled fish with elastomer tags actually increased this year, from 1.5% to 1.9%. Most of these tags (60%) were in yearling chinook (unknown race) from either Lyons Ferry hatchery on the Snake River or Easton Pond on the Yakima River. Table A-7 contains more detail for these marks.

Freeze Brands
A total of 3 freeze brands were observed in 2001, down from 284 last year. All brands were on hatchery summer steelhead and originated from the Lyons Ferry hatchery on the Snake River (Table A-7). This dramatic decline in freeze brand numbers may be due to the poor survival estimates for steelhead in the Columbia River Basin in 2001, as discussed in FPC memos. For a summary of brands per year by species see Table A-8.

Performance Monitoring
Personnel
Due to the small (2) and experienced sampling crew this year, the quality control program at John Day Dam was modified. A digital camera (Kodak DC290) was used to photograph fish if only one person was working. The picture could be discussed later and decisions reviewed. When both crewmembers were working, questionable fish were discussed with fish in hand. The ability to review and discuss specimens without delaying processing or prolonging exposure to the fish anesthetic were significant benefits of this approach. The system was useful in checking species identification, fin clips, descaling, fish condition, and brand/tag recognition. This archive also allows off-site personnel and training groups to view important biological characteristics, particularly in the off-season, which helps increase the accuracy and improve consistency of the in-season data.

Equipment
Lost or biased sample time totaled 16.5 hours this season, which is approximately 3 times the total down time recorded during 2000. All of this lost sample time was due to scheduled dewaterings of the PDS. See Table 2 for details on biased sample days.

Table 2. John Day sampling interruptions 2001.

End Date	Batch #	Reason for interruption	Hours Missed
11-June	01163	Scheduled inspection	8:20
23-July	01205	Scheduled inspection	8:15
		Minimum total sample hours missed =	16:35

The screen cleaning system at the PDS was out of service for approximately 96 days or 56% of the sampling season in 2001. This is an improvement from 2000 when the screen cleaner was inoperable for 80% of the season. During normal operating situations, the screen cleaners are cycled every two hours. When the screen cleaners could not be operated in the manual mode, accessible portions of the screen were cleaned by hand with a long handled brush. Problems with the system varied but electrical, mechanical, and programming difficulties persisted throughout the season (April - September). Fortunately, the debris load in the river was light this season, which helped avoid the serious damage to equipment and salmonids that can occur when debris is allowed to accumulate.

Adult Catch

The SMF is equipped with an adult sampling system, which was used for the first time by the CoE Fisheries Field Unit (FFU) in 2001. In addition to this effort and to gauge the quantity of fish exiting the PDS, a hinged gate, installed in 1998 just downstream of the FDS bars, tallied adults as they passed the gate. This fallback passage number was recorded every other hour throughout the season. Not every fish that passed through the gate tripped the tally mechanism and it wasn't possible to collect species detail so non-salmonids are included in the count. The number should be used as a relative indicator of fallback abundance only. A total of 4,685 adult fish were tallied between 30 March and 17 September, which is about 92% of the 2000 tally and 48% of the 1999 tally. Approximate passage times were recorded to document any obvious passage timing trends. Passage during the day (0700 to 2000 hours) was approximately 61% which is similar to the 2000 observations when 54% passed during the day. See Table A-9 for a summary of fallbacks since 1998.

Initially, the concern over adults holding in the PDS came from the number of adult fish found in the PDS at mid-season dewaterings (Table A-10). Eventually, this concern and the fact that such a small portion of the juvenile out-migration passes the project from mid-September through October (2-3%) led to the decision to shut down sampling in mid-September, which we did again this year.

Incidental Catch

American shad (*Alosa sapidissima*) were by far the most common incidental species captured at John Day in 2001. Juvenile shad passage started in the last week of July and peaked with an estimated 93,600 fish passing through the bypass system on 24 August. Three smaller collection peaks were also observed on 28 August (45,929), 3 September (33,675), and 7 September (30,689). From 29 July to 17 September, shad passage averaged 12,715 per day (Figure A-6). The total estimated collection number for 2001 is 648,522, only about 7.8% of the 2000 total of 8,274,057, and approximately 12.4% of the 5,235,479 collected in 1999 (Figure A-7, Table A-9).

One other substantial decrease was observed in the chiselmouth collection (1,452 to 0). The decreases in shad and chiselmouth collection numbers contrasts sharply to the large collection increases observed in other incidental species such as sculpin (3000%), mountain whitefish (302%), suckers (245%), smallmouth bass (188%), and walleye (174%). Possible explanations for this reversal of trends may be due to variations in river conditions such as extremely low flow and spill levels, lower suspended sedimentation, higher light penetration and water temperatures, or changes in the food web. Some or all of these factors may have led to higher survival rates for certain incidental species and higher mortality rates for others.

Another incidental species present in our samples in large numbers is the juvenile (or out-migrating) Pacific lamprey (*Lampetra tridentata).* Although out-migrating lamprey were found in our samples throughout the season, they did appear to have at least one distinct passage peak in 2001. The most noteworthy passage peak was 27,660 collected on 1 May, while two smaller peaks of 6,779 on 9 June and 8,212 on 17 June were also observed (Figure A-6). The total estimated lamprey collection for 2001 is 85,281. Approximately 99.5% of the out-migrating lamprey were smolted (macropthalmia), while the remaining 0.5% were ammocetes in various stages of metamorphosis. This year's collection estimate is only 60.2% of last year's estimate of 141,661, yet is still dramatically higher than all years prior to 1998 due to the switch from single gatewell to full bypass sampling (Figure A-7, Table A-9).

Research

During the season, John Day smolt monitoring personnel provided support to four research projects, listed below by agency. Support included activities such as: fish collection and enumeration, equipment set up, and handling. Fish were collected from the general sample or with the SBC system.

U.S. Geological Survey-Biological Resources Division

1. *Study to Evaluate Tailrace Egress of Juvenile Chinook Salmon that Pass via the Sluiceway Under Each Spill Scenario Tested at The Dalles Dam in 2001.* Principal Investigators: John Beeman and Theresa Liedke. Radio telemetry was used to evaluate the tailrace egress of juvenile salmon following sluiceway passage at The Dalles Dam. Fish were released into the sluiceway during both day and night conditions, and their movement paths through the tailrace were intensively monitored with a combination of fixed-site receiving stations and boat tracking. The emphasis of this study was on gathering information about fish movements within the boat-

restricted zone. A total of 1,550 yearling chinook were collected for tagging in the spring and 1,121 subyearling chinook were collected in the summer at the John Day SMF for this research.

2. *Juvenile Bypass Survival Study, John Day Dam Sampling Facility, 2001.* Principal Investigators: Timothy Counihan and James Petersen. The goal of this research was to use radio telemetry to generate juvenile salmonid survival estimates at John Day and Bonneville dams, including total project survival and route specific survival. A total of 868 yearling chinook, 945 steelhead, and 1,191 subyearling chinook were collected for radio tagging at the John Day SMF for this research.

National Marine Fisheries Service (NMFS) and the Yakama Indian Nation (YIN).

3. *Physiological Assessments of Wild and Hatchery Juvenile Salmonids.* Principal Investigators: NMFS, Donald Larson; YIN, Bruce Watson. This study collected fish using the SBC capabilities at John Day SMF. The objective of their research was to make physiological assessments of wild and hatchery juvenile yearling chinook salmon during the 2001 out-migration. The SBC system diverted a total of 95 target chinook and 291 non-target salmon smolts.

Pacific Northwest National Laboratory (PNNL) -Battelle

4. *Effects of Dam Screening Bypass Facilities on Juvenile Pacific Lamprey.* Principal Investigator: Robert Mueller, Russel Moursund. In 2001, PNNL continued a study to evaluate the effects of Extended Length Bar Screens (ESBS) and other project operations on juvenile Pacific lamprey survival. One task was to determine if juvenile lamprey could be successfully PIT tagged and detected within the bypass system. Also, to observe interactions between fish and ESBS's, video cameras were mounted on brush heads and recorded behavior during May and June at McNary Dam. Approximately 771 outmigrating Pacific lamprey were collected in April and May for this research.

BONNEVILLE DAM

The shift in sampling effort from PH1 to PH2 that began last year was continued this year; specifically, index level sampling at PH2 and condition monitoring and GBT exams only in PH1. Sampling began at 0700 hours on 13 March and concluded at 0700 on 31 October at the Hamilton Island Juvenile Monitoring Facility (JMF). Sampling in PH1 began on 3 April and ended on 31 July. PH1 sampling ended early primarily because the powerhouse was not operating. Table B-1 (PH2) and Table C-1 (PH2) are summaries of all years of sampling including sample dates, sampling effort, sample, collection, and index numbers.

The Numbers - Second Powerhouse

Sample Numbers

The total number of fish sampled at the JMF was 100,457, about twice the number sampled last year (54,070). The species composition was as follows: subyearling chinook, 52%; coho, 22%; yearling chinook, 19.5%; clipped steelhead, 2.8%; unclipped steelhead, 2.4%; and sockeye, 1.1%. The increase in sample numbers is due to operational priority being given to PH2, and the low river flow, resulting in little spill and very little generation in PH1.

Collection Estimates

This is only the second year in which we have a collection estimate for the second powerhouse and it is 5,606,915, about twice last years collection estimate of 2,790,908. The species composition for the collection estimate can be different from the composition of the sample numbers due to the use of multiple sample rates and changing species composition throughout the day and season. For the composition of the fish using the bypass system, the percentages are as follows: subyearling chinook, 41.9%; coho, 26.7%; yearling chinook, 23.6%; hatchery steelhead, 3.5%; wild steelhead, 3%; and sockeye, 1.4%.

There are numerous components that affect collection estimates, but the primary factor is flow distribution. In 2000, a larger proportion of the flow went through the first powerhouse and there was more spill. Consequently, more fish passed the project through those routes rather than through PH2. This year, with the extremely low flows, PH1 operation and spill were much reduced and almost all available river flow went through PH2, making it the primary passage route for downstream migrants, inflating our collection estimate.

Fish Passage Indices
Collection numbers are divided by the proportion of river flow through PH2 to get an FPI for the entire project. The FPI is a relative indicator of fish abundance. It is affected by the same factors as the collection estimates, discussed above, and others. It is most useful for in-season monitoring of run timing and size. The 2001 index total for all species combined was 7,388,877, which is about 82% of last years 9,054,957. Sample, collection, and index numbers by species can be found in Table 1. See the Fish Passage Center annual report for more information.

Fry Incidence
At PH2 the number of chinook fry (< 60mm) sampled this season was 530, which expanded to a collection estimate of 16,099. This is about 86% of last years collection estimate. Eighty five percent of the chinook fry were sampled in April (42%) and May (43%).
Coho fry are usually present in smaller numbers and this year was no exception. A total of 27 coho fry were sampled which expanded to a collection estimate of 530. In 2000, the collection estimate was only 40. The majority of the coho fry are sampled in April (60%), with near equal numbers in March (22%) and May (18%).
See Figure 8 for a graphic summary of chinook fry passage and Table B-1 for a historical fry summary.

<u>The Numbers-First Powerhouse</u>

Sample Numbers
The total number of fish sampled in the first powerhouse at Bonneville Dam in 2001 was 5,931. This is about a third of last year's sample size, and the sampling effort was similar. Starting in 2000, sampling in PH1 was reduced to three times per week for condition monitoring only. The reduction in sample numbers this year is due to the low river flow and the operational priority being placed on PH2. Those factors combined to minimize PH1 turbine operation and corresponding fish recruitment. Species specific sample numbers for this year can be found in Table 1; Table C-1 presents sample numbers and other data for all years of sampling in PH1. Species composition was as follows: subyearling chinook, 71.6%; yearling chinook, 19.6%; coho, 6.7%; unclipped steelhead, 1.5%; clipped steelhead, 0.4%; and unclipped sockeye, 0.2% (Table 1).

Fry Incidence
At PH1, 6 chinook and 1 coho fry (<60mm) were sampled. These numbers are consistent with the low numbers seen last year when sampling effort at PH1 was reduced. Prior to 2000, both species of fry were sampled in quantities similar to what we have sampled in PH2 since 2000 (Table C-1).

<u>River Conditions</u>

River Flow
Spring river flow, through May, averaged 130.9 kcfs, or 52% of the 251.7 kcfs in 2000. The peak flow for this period was 176.4 kcfs on 18 May. This is about 46% of last year's high flow for this same period of 384.4 kcfs on 24 April. For June and July, river flow averaged 114.4 kcfs, about 135 kcfs or 55% lower than the 251.7 kcfs for the same period last year. Flows for August through October were lower than for the same period in 2000, averaging 93.7 kcfs versus 127.8 kcfs last year.

Last year, due to operational priority for surface collection studies and extended length bar screen testing at PH1, discharge from PH2 was minimal throughout the summer. This year, the situation was reversed. PH2 was given operational priority and because river flow was so low, there was little water left for PH1 or spill. For March through October, PH1 discharge averaged just 6.3 kcfs compared to an average of 28.3 kcfs last year.

Spill and Dissolved Gas
Due to the low river flow in 2001, spill for the Spring Creek hatchery releases was very limited. There were only 2 releases this year (normally there are 3), the first was on 8 March and consisted of 5.2 million fish. For this release 4 days of spill were provided, averaging 17.6 kcfs or 15% of total river flow. The second was on 19 April and was about the same number. No spill was provided for the second release. Sampling at the JMF was delayed due to construction, so only the end of the first release was sampled (Table 3).

Table 3. 2001 Spring Creek National Fish Hatchery releases.

Release Date	Number (millions)	Peak PH2 Passage	Average Spill	Spill as % of River
March 8	5.2	9 March	17.6	15
April 19	5.2	19 April	0.0	0.0

Shifting of flow from PH2 to spill following a Spring Creek release increases the number of those fish passing the project via the spillway and improves survival.

The Fish Passage Plan calls for spill from 10 April through 31 August of 75 kcfs during the day and more at night, up to the 120% total dissolved gas cap. This year spill occurred from 16 May to 16 June and averaged 47.8 kcfs, and again from 9 August through 1 September, averaging about the same amount, 47.6 kcfs.

<u>Passage Patterns</u>

Passage timing and duration summaries use index numbers which for the last two years came from PH2. This year's pattern will be compared to last year but historical comparisons (median) will use data (1987-1999) from PH1.

Juvenile passage at Bonneville followed a pattern similar to that seen at John Day, the 10% passage date or beginning of the migration was delayed but the 90% date was close to last year's date for most species. The result is the middle 80% duration was similar or shorter for all species except subyearling chinook. Species specifics follow.

Yearling chinook run timing and duration were delayed this year compared to last year and all previous years. The duration of the middle 80% was two days longer than last year and 5 days longer than the historical median (Figure 7). Over the history of the monitoring program, based on data from PH1, the days required for the middle 80% of the run to pass Bonneville has been quite consistent, ranging from 31 to 41 days (Figure C-2, Table C-2). Although a new maximum for the middle 80% duration was set this year, 42 days, it was only one day longer than the old record from PH1 (Table B-2, Figure B-2). Consequently, the first two years of passage timing data from PH2 are consistent with the pattern established with PH1 data.

Passage began to increase the third week of April and passage in significant numbers went through mid-June. There was a decline in sample numbers that coincided with the onset of spill on 16 May (Figure 8). This year's peak passage occurred at a time when passage was low last year and last year's peak occurred when this year's passage was at it's lowest point (Figure B-1).

Subyearling chinook passage is a combination of Spring Creek hatchery releases of Tule stock, all occurring prior to June, and upriver Bright stock, passing the project after 1 June, and fry (Figure 8). The Tule hatchery releases are obvious passage peaks occurring a day or two after the release dates listed in Table 3 above. Since this hatchery is only 21 miles upstream from Bonneville, and the releases are large (see Table 3) they pass in large groups (Figure 8, Figure B-1) often requiring that we minimize the sample rate or sometimes stop sampling altogether.

The passage timing and duration of the middle 80% listed in tables and shown in figures is for the upriver Bright stock, moving past Bonneville after 1 June. Passage reached the 10% point at roughly the same time as last year and previous years (partially due to the 1 June Tule cut off) but did not reach the 90% date until 15 August, a new record (Figure 7). The result was a new maximum number of days for the middle 80% to pass Bonneville of 70 days (Table B-2, Figure B-2). The daily passage of the upriver Brights occurring after 1 June is relatively consistent, exceeding 2% of total only once. Chinook fry were present in the samples from late April through May, but some fry were sampled in mid-July (Figure 8).

Unclipped steelhead passage reached the 10%, 50%, and 90% passage dates later than last year but the duration of the middle 80% of the run was actually one day shorter at 39 days (Figure 7). When compared to the historical median from PH1, the 10%, 50%, and 90% dates are all later and the duration is 5 days longer.

Unclipped steelhead were present in our samples from 20 April through mid-June with the largest passage peak of about 5% occurring on 5 May (Figure 8). It appears that spill was effective in diverting fish away from the powerhouse, based on a 3% decline in passage numbers coincident with spill (Figure 8).

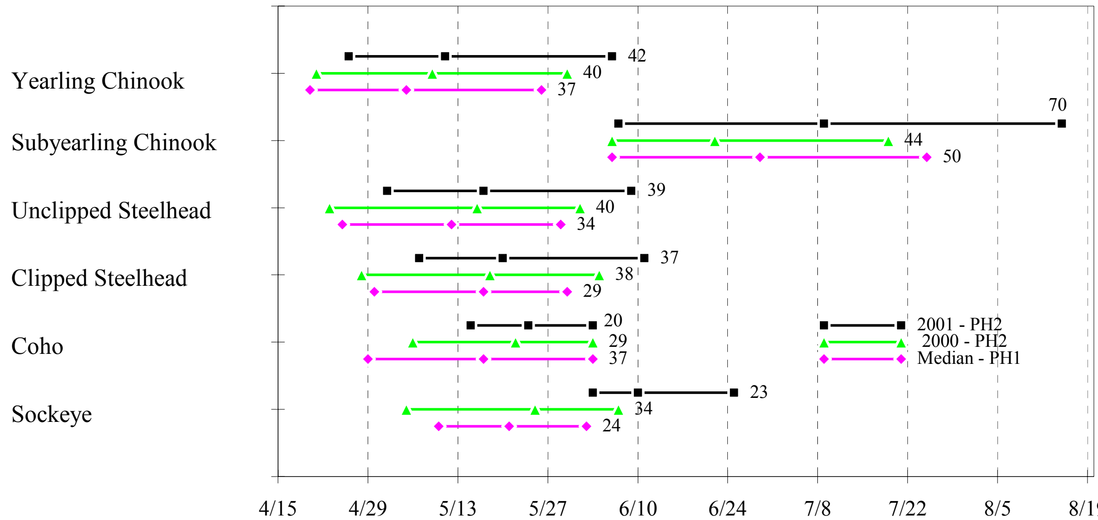


Figure 7. 10%, 50%, and 90% passage dates For 2001 and 2000 from PH2, and the historical median at PH1, 1988-1999. The duration in days between the 10% and 90% passage dates is indicated for each line.

Clipped steelhead passage was similar to unclipped steelhead passage; the 10%, 50%, and 90% passage dates were all later than both last year's dates from PH2 and the historical median from PH1 (Figure 7). The duration of the middle 80% was one day shorter than last year at 37 days but both years are considerably longer than the historical median from PH1 of 29 days. This may reflect the fact that the last two years have had lower than average spring run off and river flows, causing migration delays. Daily passage peaked just before spill began on 16 May. Once spill began, passage dropped off by about 3.5% (Figure 8).

Coho passage reached the 10% passage date later than last year but the 90% date on the same day as last year, 3 June. The net effect is a relatively short middle 80% duration of 20 days. This is the fewest days ever recorded for the middle 80% of the coho run to pass Bonneville (Figure 7, Figure B-2 for PH2, and Figure C-2 for PH1). This contrasts sharply with the John Day coho passage that saw a peak in mid-August and the longest 80% duration in history. Coho passage has varied throughout the years with the greatest variation occurring at the beginning of the run (Figure C-1).

Sockeye passage has also been highly variable throughout the years, with the middle 80% duration ranging from 11 to 48 days (Table C-2, Figure C-2). Sockeye passage at Bonneville was delayed more than for any other species. The 10% date in the migration was 4 days before last years 90% date and two days later than the historical median 90% date from PH1 data. The duration of the middle 80% was 11 days shorter than last year but about the same as the historical median from PH1 (Figure 7). The delayed migration is apparent in the sockeye graph of Figure B-1.

Diel

Diel passage summaries are based on 4 years (1992-1995) of diel sampling from PH1. Passage of all species increased starting at 2000 hours and peaked at 2200 hours. The average percent of total passage occurring at night (1800 - 0600 hours) ranges from 54.7% for yearling chinook to 70.8% for coho. For more detail on diel passage see Figure C-6, Figure C-7, Table C-8, and Table C-10.

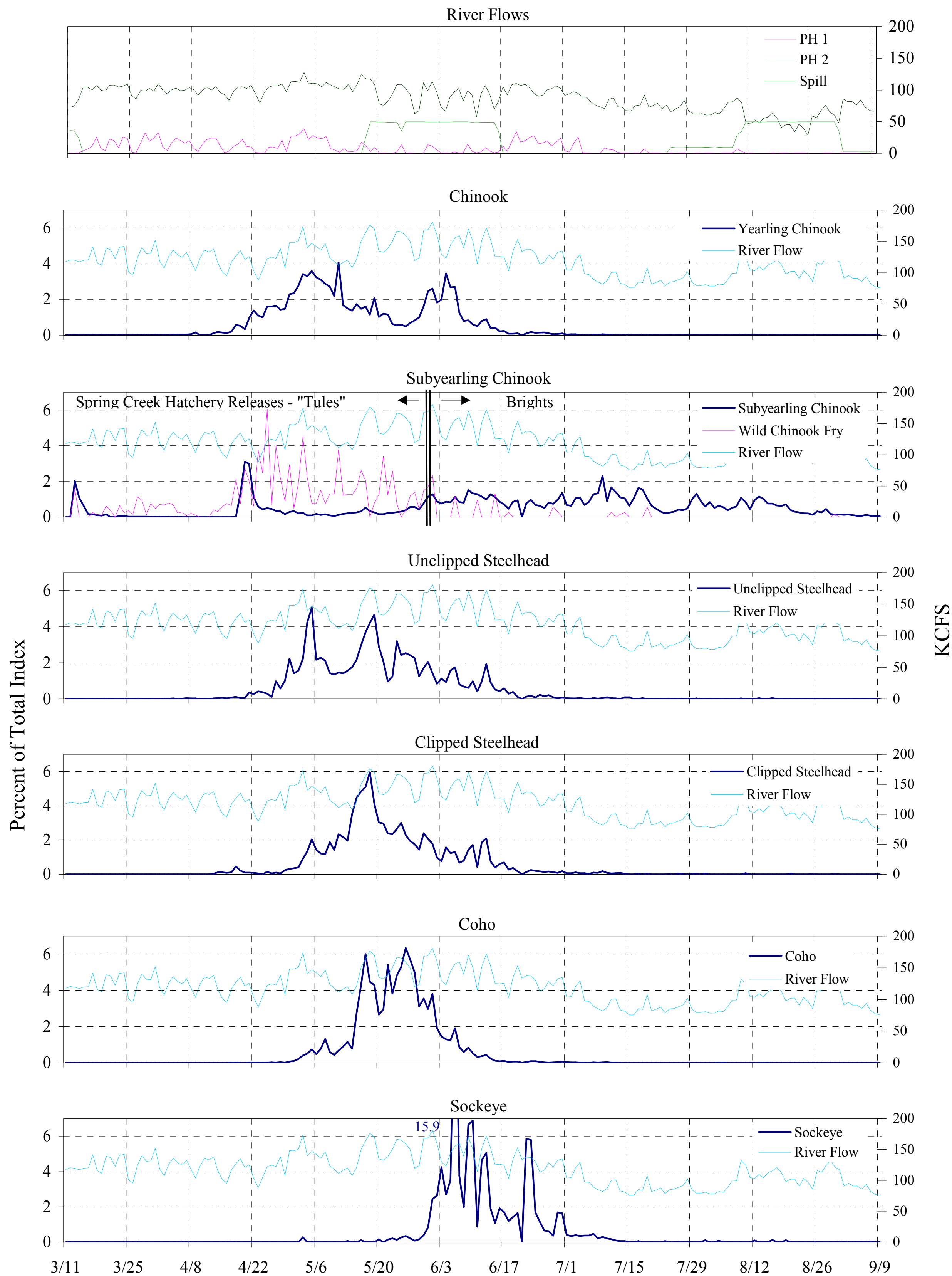


Figure 8. Seasonal passage patterns and daily average river flows at Bonneville PH2, 2001.

Fish Condition

Powerhouse 2 - Descaling

Overall, descaling at Bonneville was at or below levels seen in previous years. One of the main contributors to descaling is debris which was minimal this year.

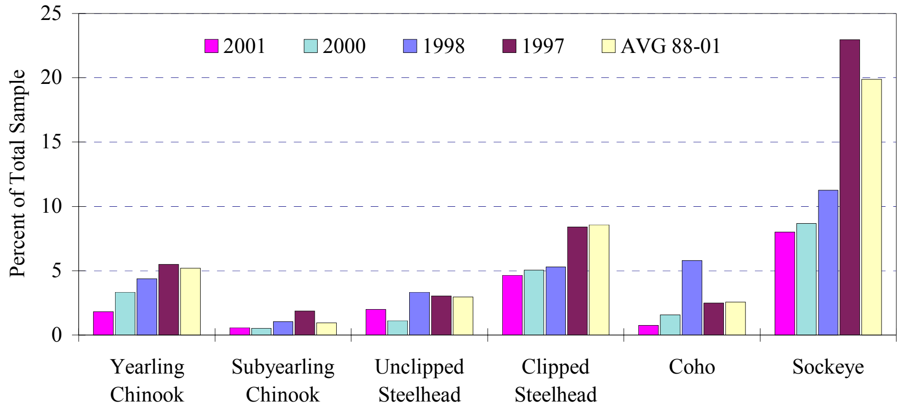


Figure 9. Total descaling for 2001 at PH2, compared to 2000, 1998, 1997 and the 88-98 average at Bonneville, PH2.

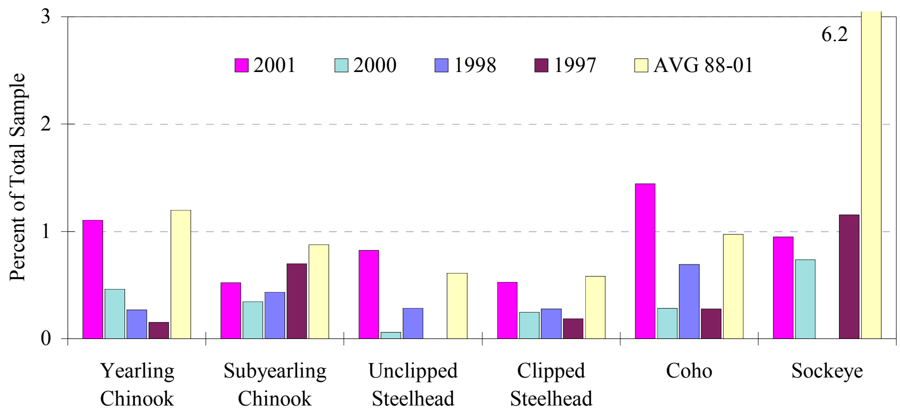


Figure 10. Total mortality for 2001 at PH2, compared to 2000, 1998, 1997 and the 88-98 average at Bonneville, PH2.

Yearling chinook descaling was down from 3.3% last year to 1.8% this year, which is the lowest rate ever recorded at PH2 (Figure 9, Table B-3, Figure B-4). Descaling averaged 2.6% for the first two years at the JMF, which is significantly lower than the 6.7% rate recorded between 1988 and 1998. Favorable migration conditions, the new dewatering system in PH2, and the new sampling facility are likely reasons for this lower descaling rate. Daily rates were highest toward the end of the migration. Mortality was up to 1.1% this year from 0.5% last year (Figure 10, Table B-3, Figure B-4). Some of the increase is due to a processing accident on 29 May that resulted in the death of about 60 fish, many were chinook (Figure B-3).

Subyearling chinook traditionally have very low descaling, and this year was no exception at 0.6%, about the same as the 0.5% seen last year (Figure 10, Figure B-4, Table B-3). The average for the last two years (0.5%) is about a third of the average for the previous 10 years (1.6%). Daily descaling increased slightly toward the end of the migration period but in general was quite low (Figure B-3). Mortality was also low at 0.5% for the season, up slightly from last year's record low of 0.3% (Figure 10, Figure B-5, Table B-3).

Unclipped steelhead descaling was up to 2.0% this year from a record low of 1.1% last year (Figure 10, Figure B-4). The average for the last two years was 1.6%, again considerably lower than the 4.8% average for the 1988 to 1998 period. Daily rates varied throughout the migration period (Figure B-3). Mortality, while quite low at 0.8%, was up from last year's low level of 0.1% (Table B-3, Figure B-5).

Clipped steelhead descaling at 4.7% was similar to last year's rate of 5.0% but below the overall average of 8.0% (Figure 9). As with the other species, the average for the last two years is lower than the average for the previous 10 years, 4.9% and 10.8%, respectively. Daily descaling was highest during the middle of the migration (Figure B-3).

Coho set a new record low for descaling at 0.7%, down form 1.6% last year (Figure 9, Table B-3). Coho descaling has always been low, averaging 4.1% for the 1988 – 1998 period, but the average for the last two years is even lower at 1.2%. Coho descaling increased throughout the migration, peaking at 8% in early June (Figure B-3). Mortality for coho is also traditionally low but was up to the second highest rate ever recoded at 1.4% (Table B-3, Figure B-5).

Sockeye descaling is usually the highest of all the species, and this year was no exception at 8% (Figure 9, Table B-3, Figure B-5). While this is higher than the other species, it is lower than previous years for this species. The last two years, sockeye descaling averaged 8.3%, which is a big improvement from the 26.6% rate for the previous 10 years. Sockeye descaling was highest in June when rates ranged between 2% and 10% on days when samples exceeded 30 fish (Figure B-3). Sockeye mortality was 0.9% for the year, up slightly from 0.7% last year (Figure 10, Figure B-5, Table B-3). Again, the average for the last two years, 0.8%, is significantly lower than the average (4.2%) for the samples from the old system (Figure B-7).

See Table B-1 for a summary of the sampling effort and results at PH2 for all years of sampling.

Powerhouse 1 - Descaling

Descaling in 2001 was lower than last year and the historical average for yearling and subyearling chinook, unclipped steelhead, and coho. Clipped steelhead and sockeye were similar to last year but higher than their historical average (Figure 11, Table C-3, and Figure C-3). The number of fish sampled in PH1 was down this year to the lowest number ever, 5,931. Descaling and mortality percentages for unclipped steelhead, clipped steelhead, and sockeye are based on sample sizes of 91, 25, and 9, respectively (Table 1, Table C-1).

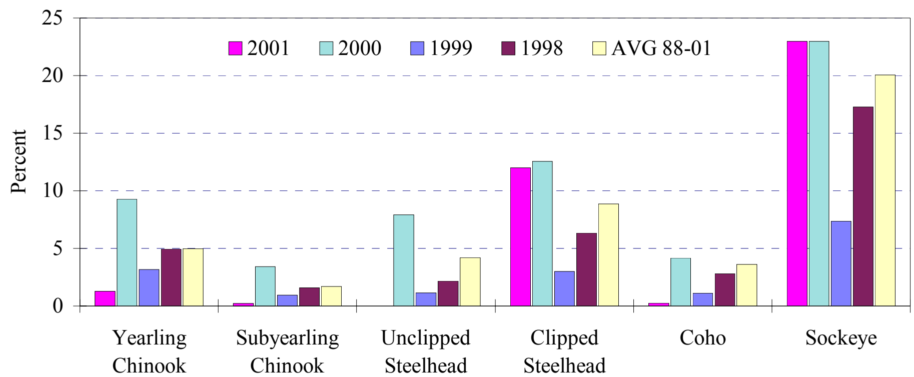


Figure 11. Total descaling for 2001 at PH1, compared to 2000, 1999, 1998 and the 88-99 average at Bonneville Dam, PH1.

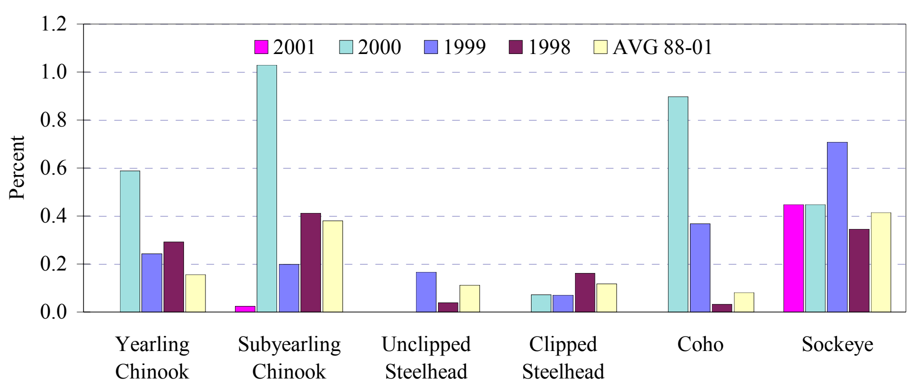


Figure 12. Total mortality for 2001 at PH1, compared to 2000, 1999, 1998 and the 88-99 average at Bonneville Dam, PH1.

Mortality
Of the 5,931 fish sampled, there were only two mortalities, one sockeye and one subyearling chinook. These show up on Figure 12 only because sample sizes are so small. See Figure C-4 for a graphic comparison of the mortality for all years and Table C-3 for a listing of the actual numbers and percentages for each species.

Subsampled Fish Condition
Powerhouse 2
Bonneville PH2 condition data was collected on yearling chinook, steelhead, coho, and sockeye from 19 March to 28 June and subyearling chinook were examined from 22 June through 31 October. A total of 20,745 smolts were examined for detailed condition subsampling in 2001 at PH2. Partial descaling ranged from 36% for sockeye to 8.6% for subyearling chinook. Partial descaling percentages were similar to last year's for sockeye (36.0% from 34.4%), clipped steelhead (33.1% from 33.5%), and coho (11.0% from 10.7%). The greatest change in partial descaling rates occurred in unclipped steelhead (15.1% from 19.4%). The incidence of attempted bird predation was higher in clipped steelhead (8.2%) than any other species (range: 0.3% to 3.3%). Incidence of external parasites on unclipped steelhead doubled to 11.8% from 5.9% while occurrence in other species remained less than 1%. Incidence of fungus was uniformly low (<1%) with the exception of yearling chinook at 4.1%. The frequency of body injuries ranged from 0.5% to 1% for all species, similar to last year, however, operculum damage rates decreased on clipped steelhead from 4.3% to 2.8%. Additional condition subsampling percentages are presented in Table B-4.

Length Averages
Individual fish lengths were obtained in conjunction with the fish condition subsampling. Since so many of the fish are of hatchery origin, this data is largely a function of size at time of release. The results are intended to show relative length trends throughout the season and are presented in Figure 13. Clipped steelhead, as in past years, remained the largest juvenile salmonid sampled throughout the season. In PH2, clipped steelhead, unclipped steelhead, and subyearling chinook showed increasing size trends as the season progressed, while yearling chinook and coho varied over the course of the migration. Conversely, a decreasing size trend was noted for sockeye over the course of the season.

In PH1, unclipped steelhead and coho lengths varied over the course of the migration. In contrast, yearling chinook size trends increased while subyearling chinook lengths remained relatively consistent throughout the season. Length data for PH1 was not graphed due to small sample sizes for some species and no reason to expect differences between powerhouses.

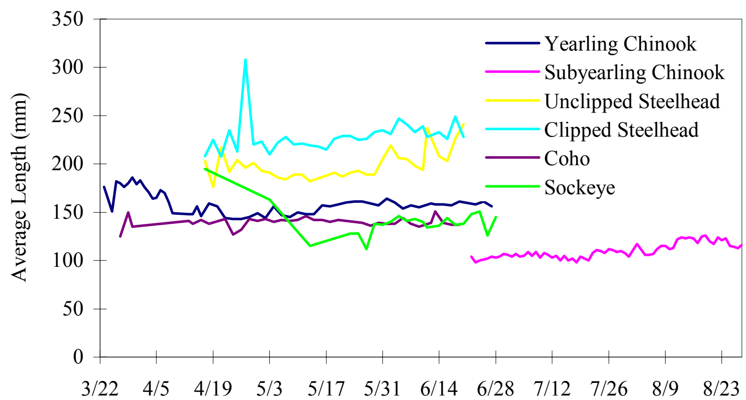


Figure 13. Average lengths for Bonneville PH2 JMF, 2001.

Powerhouse 1
Bonneville PH1 condition data was collected on yearling chinook, steelhead, coho, and sockeye from 10 April to 23 June and subyearling chinook were examined from 2 June to 19 July. A total of 2,422 smolts were examined for detailed condition subsampling in 2001. Partial descaling (3-19%) was the most prevalent condition in the PH1 samples and ranged from 28.6% for sockeye to 3.3% for unclipped steelhead. Similar numbers were noted for sockeye (27.8%) last year; however, partial descaling for unclipped steelhead was over four times greater (13.8%) in 2000. The incidence of attempted bird predation was highest for clipped steelhead at 8.7%, down from 11.5%. The incidence of external parasites on unclipped steelhead almost doubled (16.4% from 8.7%). Body injury rates were highest in yearling chinook (0.9%) and subyearling chinook (0.7%) compared to clipped steelhead (1.9%) and coho (1.7%) last year. For more details on this data and a historical summary of condition subsampling, see Table C-4.

Gas Bubble Trauma (GBT) Monitoring
GBT examinations began on 10 April and ended on 30 August 2001. Fish were obtained from PH1 samples until 12 July when low fish numbers forced us to get fish from PH2 samples. Operational priority of the second powerhouse and lack of remaining water for PH1 resulted in very few fish in the PH1 samples.. Gas bubbles were found in only 1 of 3,161 fish examined in 2001 for an overall incidence of 0.03%. The lone symptom was observed on a fall chinook in July and was rank 1 in the lateral line. Fall chinook were observed with 0.05% (1 of 2,137) incidence while no other species possessed symptoms (Table C-7). The low incidence rate is a direct result of diminished flows and spill throughout the season. For more details on the gas bubble monitoring results, see the Fish Passage Center annual report.

Passive Integrated Transponder (PIT) tags and External Marks
PIT Tags
A total of 47,505 PIT tags were detected at Bonneville this year, a 45% decrease from 2000 (86,842). The decline in detections is partially due to the termination of The Dalles Spillway Survival study, which added almost 300,000 tags to the river last year. Decreased survival of in-river migrants may also have contributed to the decline. The low flows and operational priority of PH2 resulted in minimal PH1 generation and a corresponding low number of detections (881). The balance, 46,624, was detected at the JMF. A summary (by species, run, and rearing type) of PIT tags detected at Bonneville for 2001 can be found in Table B-5. Table B-6 summarizes PIT tag records by year for all years of interrogation at Bonneville.

Elastomer Tags
At PH2, 331 elastomer tags were recorded in 2001, which represents 108% of the 307 observed in 2000 (Figure B-7). The proportion of sampled yearling chinook with elastomer tags decreased this year, from 1.6% to 1.2%, while the percentage of sampled steelhead recorded with elastomer tags increased from 0.6% to 1.2%. Fifty-three percent (177) of those were observed on unknown yearling chinook, while 25% (82) were recorded on yearling spring chinook, all from Lyons Ferry or Cle Elum hatcheries. Only 1% were noted on yearling fall chinook from Lyons Ferry hatchery. The remaining 21% (68) were summer steelhead originating from Chiwawa hatchery on the Wenatchee River (Table B-7).

Due to low flows and operational priority of the second powerhouse, only 4 elastomer tags were recorded at PH1 this year, down from 85 in 2000. Two were observed on yearling spring chinook released into the Yakima River from Cle Elum hatchery, while the other two were recorded on unknown yearling chinook from either Lyons Ferry Hatchery or Cle Elum hatchery and were released into the Snake, Clearwater, or Yakima rivers (Table C-7).

Freeze Brands
No freeze brands were recorded in PH2 this year, down from 11 in 2000 (Table B-8). Similarly, no freeze brands were observed PH1, unchanged from 2000 (Table B-8).

Adult Catch
At the JMF, the separator bars on the PDS juvenile hopper are designed to exclude adult fish from the general sample. However, small adult salmonids may occasionally pass through the separator bars and get diverted to the sample collection tank and many more can get stuck on the separator bars. In 2001, only one chinook jack was caught in our samples, compared to 11 chinook jacks, one chinook minijack, and one adult steelhead (kelt) in 2000. However, we did record 199 kelts getting stuck between the separator bars this year. Of those, 61 were recorded as dead on release. Numerous structural and procedural changes will be made for the 2002 season to address this problem.

At PH1, adult excluder bars prevent most adults from being collected.

Incidental Catch
Powerhouse 2
In PH2, American shad *(Alosa sapidissima)* juveniles were the most prevalent incidental species sampled. Juvenile shad were present in significant numbers in the samples from late August through the end of October. Two distinct passage peaks occurred on 16 October and 29 October representing collection estimates of 168,136 and 100,345,

respectively. The total collection estimate for 2001 was 1,376,845, only about 31.6% of the 2000 total of 4,359,372 (Figure B-6, Table B-9).

Pacific lamprey *(Lampetra tridentata)* juveniles were found in samples from March through August. Three distinct passage peaks occurred on 13 May, 12 June, and 15 July representing collection estimates of 461, 500, and 300 respectively (Figure B-6). The total collection estimate for the season was 9,635 (Table B-9), of which over 97.5% were smolted. This season's collection estimate represents 128% of last years total of 7,500.

Substantial increases were observed in the collection estimates of other species such as sculpin (454 to 99,853), stickleback (319 to 71,718), and peamouth (3,416 to 8,971). Possible explanations for these dramatic increases may be due to extremely low flow and spill levels, lower suspended sedimentation, higher light penetration and water temperatures, or changes in the food web. Some or all of these factors may have led to higher survival rates for certain incidental species and higher mortality rates for others.

Powerhouse 1

Only 58 incidentals were recorded at PH1 this year, down from 703 in 2000. Of those, 74% were sculpin. See Table C-6 for a summary of others species sampled and a summary for all years of sampling.

<u>Performance Monitoring</u>

Personnel

As part of our quality control program, we used a method of checking species identification, fin clips, descaling, and brand/tag recognition skills. Two people examined the same 10 fish and compared results. Any discrepancies were discussed while the fish was in hand. For a full explanation of the test protocol, see the Methods section. The "Descaled" category generated the lowest efficiency rating at 97.7%. Overall, coworkers were in agreement 99.2% of the time (Table 4).

Table 4. Results of quality control tests.

Category	**ID**	**Clip**	**Descaled**	**Mark**	**Total**
Errors	0	0	26	0	26
Possible	1120	1120	1120	8	3368
% Correct	100	100	97.7	100	**99.2**

Equipment

At the PH2 JMF, 166 hours of sampling was missed, about 3% of the season (Table 5). At PH1, 48 hours of sampling were missed this season, about 12% of the season (Table 6).

Table 5. PH2 sampling interruptions, 2001.

End Date	Batch Number	Reason for Interruption	Hours Missed
3/21	01080	PDS screen repairs	20.5
3/22	01081	Monitoring facility dewatered	24
3/23	01082	Monitoring facility dewatered	9
4/10	01100	SDS and flume repairs	24
4/11	01101	Monitoring facility dewatered	24
4/12	01102	Monitoring facility dewatered	24
4/13	01103	Monitoring facility dewatered	9.5
5/23	01143	Sample diversion gate turned off inadvertently	2
6/21	01172	PDS and sample tank crowder repairs	24
6/22	01173	Monitoring facility dewatered	5
		Total hours missed	**166**

Table 6. PH1 sampling interruptions, 2001.

Date	Batch Number	Reason for Interruption	Hours Missed
5/13	01133	Flat Plate lift mechanism repairs	8
5/15	01135	Flat Plate lift mechanism repairs	8
5/17	01138	Flat Plate lift mechanism repairs	8
7/27	01208	Flat Plate lift mechanism repairs	8
7/29	01210	Flat Plate lift mechanism repairs	8
7/31	01213	Flat Plate lift mechanism repairs	8
		Total hours missed	**48**

Research

During the season, Bonneville smolt monitoring personnel provided support to four research projects listed below. Support included activities such as: fish collection and enumeration, equipment set up, and handling. Fish were collected from the general sample or by the SBC system.

U.S. Geological Survey-Biological Resources Division

Movement, Distribution, and Passage Behavior of Radio-Tagged Juvenile Salmonids at Bonneville Dam associated with FPE and Survival Tests. Principal Investigator: Noah S. Adams. Fish were radio tagged to monitor the behavior of juvenile salmonids as they approach and pass through Bonneville passage routes (PH1, PH2, and Spillway) during fish passage efficiency and survival tests.
A total of 2,536 yearling chinook, and 1,616 subyearling chinook were held at the JMF for this research in 2001.

Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University

Evaluation of Migration and Survival of Juvenile Steelhead Following Transportation and Evaluation of Migration and Survival of Juvenile Fall Chinook Following Transportation. Principal Investigator: Carl Schreck. The objectives of this study were aimed at understanding whether barging is affecting, through physiological condition, smolt migration behavior in relation to saltwater entry, vulnerability to avian predators, and survival of barged versus run-of-the-river fish in the Columbia River estuary. A total of 187 clipped steelhead and 170 subyearling fall chinook were collected for this research.

National Marine Fisheries Service, Fish Ecology Division.

A Study to Compare Long-term Survival and Disease Susceptibility of Yearling Hatchery Chinook Salmon Smolts with Different Juvenile Migration Histories. Principal Investigator: Lyle Gilbreath. This research is designed to potentially determine the mechanism(s) that cause differential adult return rates of Snake River chinook salmon depending on their downstream passage history (bypass, multiple bypass, and transportation) at Snake River dams. Goals in 2001 were: 1) construct and demonstrate function of an artificial seawater recirculation system at Bonneville Dam, 2) estimate variance in delayed mortality of juvenile chinook salmon held long-term (up to eight months) in this system, 3) compare delayed mortality and physiology among run-of-river versus barged yearling chinook salmon, and 4) test effects of bypass system passage on immune competency of chinook salmon through disease challenge tests using the marine pathogen *Vibrio anguillarum*.
Juvenile yearling chinook salmon (*Oncorhynchus tshawytscha*) used in the study were obtained at the JMF and from transport barges passing Bonneville. Delayed mortality comparisons were made for PIT tagged chinook salmon from transport barges and from the run-at-large passing PH2.

Idaho Cooperative Fishery Research Unit, University of Idaho

Effects of Multiple Dam Passage and Transportation on the Physiological Condition of Migrating Juvenile Salmon and Steelhead. Principal Investigator: James Congleton. Fish were collected using the Separation by Code (SBC) capabilities of the system. The objective of this research was to evaluate the effects of multiple dam passage on the physiological condition of salmon smolts. The SBC system diverted a total of 175 target hatchery spring chinook.

ACKNOWLEDGMENTS

Support for this monitoring project comes from the region's electrical ratepayers through the Bonneville Power Administration under the Northwest Power Planning Council's Fish and Wildlife Program. The success of this program continues to involve cooperative interaction with the Fish Passage Center staff, the Corps of Engineers project personnel, National Marine Fisheries Service biologists, and the Pacific States Marine Fisheries Commission.

We acknowledge the very capable efforts of our Biological technicians and laborers, including at Bonneville: John Barton, Alan Day, Larry Dick, Martha Jenkins, Nickie McConnell, Robert B. Mills, William Myers, Jerry Rogers, Thomas Ryan, Joe Tanzer, and John Windsor; and at John Day: Phillip Smith.

LITERATURE CITED

Fish Passage Manager, 1999. 1998 Fish Passage Center Annual Report. Columbia Basin Fish and Wildlife Authority, Portland, OR. 93p plus Appendices. (Annual Report to BPA for project no. 94-033, contract DE-FC79-88BP38906).

Gessel, M.H., L.G. Gilbreath, W.D. Muir, and R.F. Krcma, 1986. Evaluation of the Juvenile Collection and Bypass Systems at Bonneville Dam- 1985. U.S. Dept. Comm., NOAA, NMFS, NW&AFC, Seattle, WA. 63p plus Appendices. (Report to U.S. Army Corps of Engineers, Contract DACW57-83-H 001).

Martinson, R. D., J. W. Kamps, G. M. Kovalchuk, D. Ballinger. 1999. Monitoring of Downstream Salmon and Steelhead at Federal Hydroelectric Facilities - 1998. U.S. Dept. of Comm. , NOAA, NMFS, ETSD, Portland, OR. 1998 Annual Report (DOE/BP-20733-11) to BPA, Project 84-014, Contract DE-AI79-85BP20733. 64p.

Martinson, R. D., G. M. Kovalchuk, R. B. Mills, and J. W. Kamps. 1998. Monitoring of Downstream Salmon and Steelhead at Federal Hydroelectric Facilities - 1997. U.S. Dept. of Comm. , NOAA, NMFS, ETSD, Portland, OR. 1997 Annual Report (DOE/BP-20733-11) to BPA, Project 84-014, Contract DE-AI79-85BP20733. 64p.

Krcma, R. F., M. H. Gessel, W. D. Muir, S. C. McCutcheon, L. G. Gilbreath, and B.H.Monk, 1984. Evaluation of the Juvenile Collection and Bypass System at Bonneville Dam-1983. U.S. Dept. Comm., NOAA, NMFS, NW&AFC, Seattle, WA. 56p plus Appendices. (Report to U.S. Army Corps of Engineers, Contract ACW57-83-F-0315).

RELATED PUBLICATIONS

Other project reports and related publications available through the professional literature or from the Bonneville Power Administration Public Information Center - CKPS-1, P.O. Box 3621, Portland, OR. 97208-3621.

1999 - 2000

Martinson, R.D. et al. Monitoring of Downstream Salmon and Steelhead at Federal Hydroelectric Facilities. Pacific States Marine Fisheries Commission, Gladstone, OR. Annual Report to BPA, Project 87-127, Contract DE-AI79-85BP20733.

1995 - 1999

Martinson, R.D. et al. Monitoring of Downstream Salmon and Steelhead at Federal Hydroelectric Facilities. U.S. Dept. of Comm., NOAA, NMFS, ETSD, Portland, OR. Annual Report to BPA, Project 84-014, Contract DE-AI79-85BP20733

1996

Brege, D. A. et al. Seasonal and Diel Passage of Juvenile Salmonids at John Day Dam on the Columbia River. North American Journal of Fisheries Management 16: 659-665.

1991 - 1994

Hawkes (Wood), L. A. Monitoring of Downstream Salmon and Steelhead at Federal Hydroelectric Facilities. U.S. Dept. of Comm., NOAA, NMFS, ETSD, Portland, OR. Annual Report to BPA, Project 84-014, Contract DE-AI79-85BP20733.

1990

Johnsen, R. C. et al. Monitoring of Downstream Salmon and Steelhead at Federal Hydroelectric. U.S. Dept. of Comm., NOAA, NMFS, ETSD, Portland, OR. Annual Report to BPA, Project 84-014, Contract DE-AI79-85BP20733.

Table A-1. John Day smolt monitoring program historical summary, 1985-2001.

Year	Dates[1]	Sampling Effort	Sub-Sampling	Sample Rate	Yearling Chinook Sample #	Yearling Chinook Collection	Yearling Chinook Index	Subyearling Chinook Sample #[2]	Fry	Collection[2]	Fry	Index	Coho Sample #	Coho Collection	Coho Index
1985[3]	4/27-10/29	24/day	NO	1	63,578	63,578	-	226,577		226,577		-	600	600	-
1986	3/28-10/30	24/day	NO	1	92,591	92,951	-	182,117		182,117		-	1,994	1,994	-
1987	4/1-11/30	24/day	NO	1	84,455	84,455	1,020,768	95,505	780	95,505	780	760,605	13,200	13,200	170,353
1988	3/30-10/31	24/day	NO	1	34,045	34,045	408,675	109,448	3,800	109,448	3,800	363,101	8,650	8,650	109,325
1989	3/28-10/31	24/day	NO	1	34,930	34,930	502,642	129,870	3,922	129,870	3,922	1,017,342	6,930	6,930	99,811
1990(5b)	3/27-10/31	24/day	NO	1	26,992	26,992	361,968	39,602	30	39,602	30	513,669	6,261	6,261	84,342
1991	4/7-10/31	24/day	NO	1	26,878	26,878	374,387	46,785	513	46,785	513	568,206	5,106	5,106	72,725
1992(3c)[4]	3/25-10/13	24/day	NO	1	23,052	23,052	NA	27,407	141	27,407	141	NA	5,887	5,887	NA
1992(3b)	3/25-10/13	24/day	NO	1	19,179	19,179	237,172	32,376		32,376		294,861	3,917	3,917	48,898
1993(3c)	4/6-10/29	24/day	NO	1	11,054	11,054	NA	50,243	1,317	50,243	1,317	NA	3,437	3,437	NA
1993(3b)	4/6-10/29	24/day	NO	1	41,767	41,767	720,361	66,561		66,561		717,434	9,727	9,727	173,193
1994	4/5-9/30	24/day	NO	1	34,071	34,199	446,854	75,164	47	121,272	47	1,207,368	11,385	11,413	151,135
1995	4/6-9/29	24/day	YES	.25-1	34,308	90,348	1,329,229	48,896	507	90,350	1,350	1,240,260	5,908	22,135	335,902
1996	4/8-9/9	24/day	YES	.25-1	14,560	38,975	738,311	31,157	105	46,232	217	737,841	8,551	27,043	504,863
1997	4/8-9/8	24/day	YES	.25-1	4,586	7,646	154,026	20,487	1,305	24,333	2,342	448,328	3,409	6,615	147,267
1998	4/9-10/31	24/day	YES	.0067-.25	27,732	758,689	1,147,861	31,178	159	1,584,083	4,229	2,155,479	5,330	370,277	572,762
1999	4/1-10/31	24/day	YES	.0067-.5	160,378	1,597,819	2,193,904	232,131	675	3,090,201	7,012	3,962,632	37,941	388,932	543,318
2000	4/2-9/18	24/day	YES	.0067-1	124,788	579,810	827,047	197,340	1,021	1,132,204	6,555	1,681,685	57,716	172,742	263,724
2001	3/30-9/17	24/day	YES	.0067-.25	41,659	948,154	1,006,079	40,215	54	2,840,619	1,352	2,848,404	3,037	79,576	81,644

Year	Dates	Sampling Effort	Sub-Sampling	Sample Rate	Unclipped Steelhead Sample #	Unclipped Steelhead Collection	Unclipped Steelhead Index	Clipped Steelhead[5] Sample #	Clipped Steelhead Collection	Clipped Steelhead Index	Sockeye Sample #	Sockeye Collection	Sockeye Index	Total Sample #	Total Collection	Total Index
1985[3]	4/27-10/29	24/day	NO	1	36,616	36,616	-		-		17,235	17,235	-	344,606	344,606	-
1986	3/28-10/30	24/day	NO	1	37,822	37,822	-		-		17,505	17,505	-	332,029	332,389	-
1987	4/1-11/30	24/day	NO	1	23,988	23,988	300,410		-		11,911	11,911	145,232	229,059	229,059	2,397,368
1988	3/30-10/31	24/day	NO	1	14,985	14,985	179,089		-		6,333	6,333	80,406	173,461	173,461	1,140,596
1989	3/28-10/31	24/day	NO	1	19,818	19,818	281,685		-		5,496	5,496	78,190	197,044	197,044	1,979,670
1990	3/27-10/31	24/day	NO	1	5,028	5,028	68,428	4,921	4,921	6,349	1,755	1,755	23,592	84,559	84,559	1,058,348
1991	4/7-10/31	24/day	NO	1	5,456	5,456	75,687	11,166	11,166	158,305	3,450	3,450	52,203	98,841	98,841	1,301,513
1992(3c)[4]	3/25-10/13	24/day	NO	1	2,770	2,770	NA	6,917	6,917	NA	1,647	1,647	NA	67,680	67,680	NA
1992(3b)	3/25-10/13	24/day	NO	1	2,371	2,371	28,712	5,053	5,053	63,494	961	961	12,051	63,857	63,857	685,188
1993(3c)	4/6-10/29	24/day	NO	1	4,668	4,668	NA	7,416	7,416	NA	813	813	NA	77,631	77,631	NA
1993(3b)	4/6-10/29	24/day	NO	1	11,374	11,374	189,400	45,520	45,520	882,474	14,072	14,072	272,869	189,021	189,021	2,955,731
1994	4/5-9/30	24/day	NO	1	7,604	7,604	96,800	14,454	14,457	189,420	7,260	7,270	96,621	149,938	196,215	2,188,198
1995	4/6-9/29	24/day	YES	.25-1	4,043	11,584	170,993	18,915	61,385	919,021	5,625	19,526	293,065	117,695	295,328	4,288,470
1996	4/8-9/9	24/day	YES	.25-1	3,973	11,903	228,911	11,171	36,174	701,899	1,147	3,373	64,584	70,559	163,700	2,976,409
1997	4/8-9/8	24/day	YES	.25-1	4,011	7,337	151,061	13,645	28,547	614,087	738	1,184	26,519	46,876	75,662	1,541,288
1998	4/9-10/31	24/day	YES	.0067-.25	8,378	296,969	455,339	6,214	408,195	634,446	4,479	338,099	523,866	83,311	3,756,312	5,489,754
1999	4/1-10/31	24/day	YES	.0067-.5	33,545	299,072	418,515	42,003	586,952	820,431	54,710	407,398	574,062	560,708	6,370,374	8,512,862
2000	4/2-9/18	24/day	YES	.0067-1	44,416	188,601	271,975	38,475	182,036	250,020	17,012	41,126	59,951	479,747	2,296,519	3,354,403
2001	3/30-9/17	24/day	YES	.0067-.25	7,567	123,614	124,829	3,394	64,287	66,302	3,023	96,207	103,973	98,895	4,152,457	4,232,594

[1] Sampling conducted 24/7 for all years.
[2] Includes fry numbers.
[3] Unit 3B was out of service from April 2-26 for STS installations and testing.
[4] 3C airlift inoperational 5/13-6/18.
[5] Unclipped and clipped steelhead were not differentiated prior to 1990.

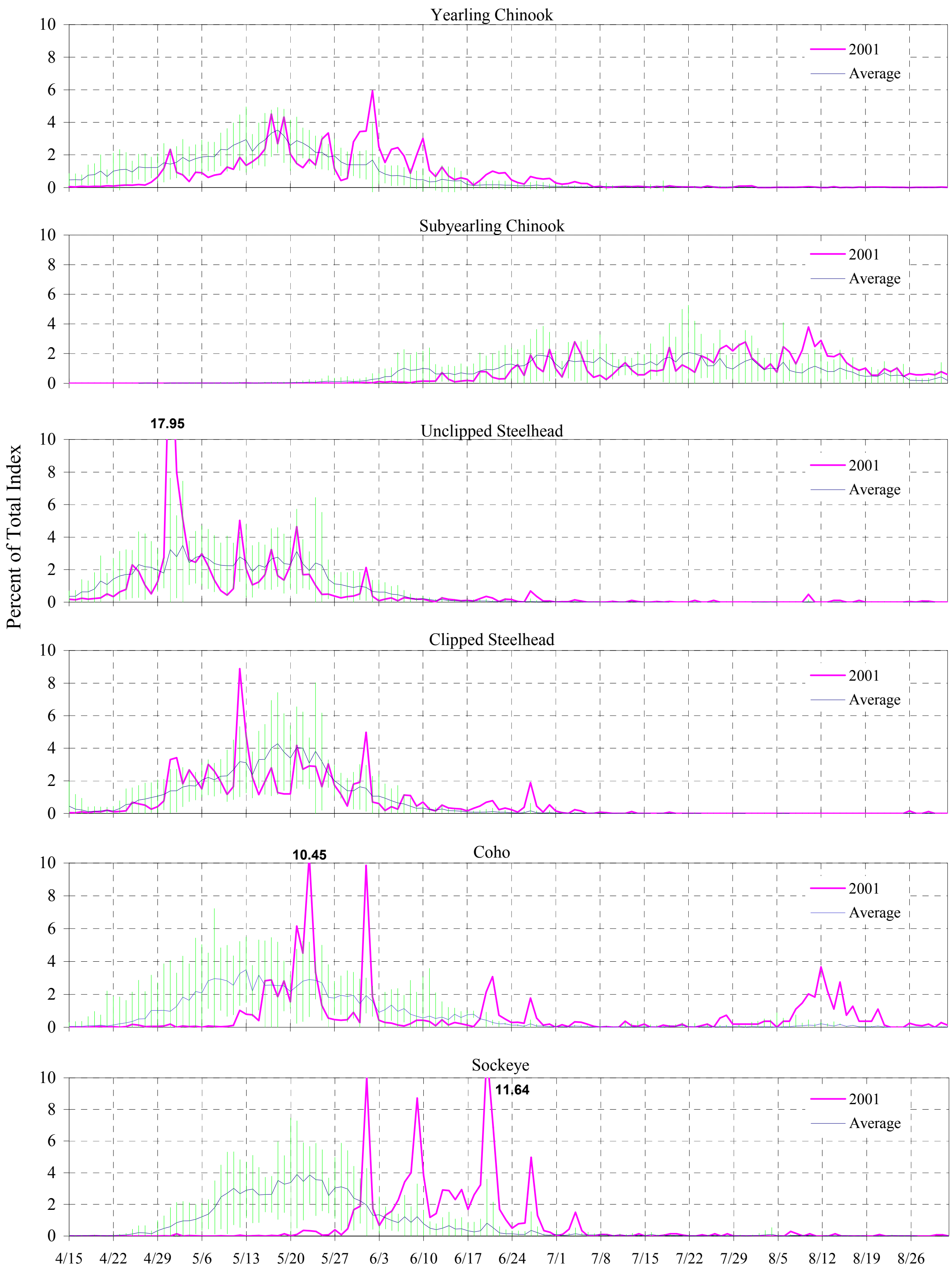


Figure A-1. John Day average daily passage with standard deviation, 1985-2001graphed with current year.

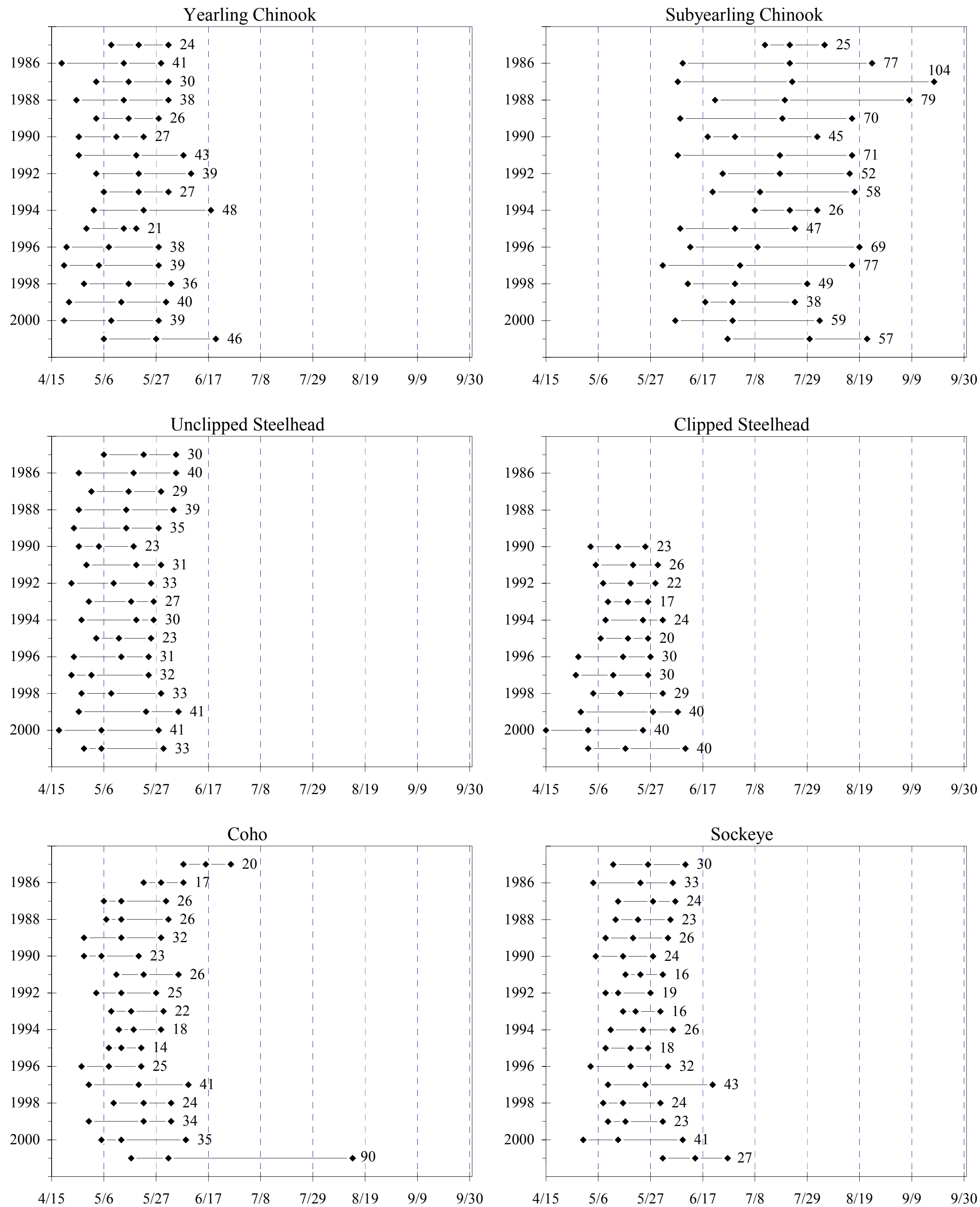


Figure A-2. John Day 10%, 50%, and 90% passage dates by species, 1985-2001. The number of days between 10-90% dates is indicated for each year. Clipped and unclipped steelhead were not differentiated before 1990.

Table A-2. John Day 10%, 50%, and 90% passage dates, 1985 to 2001, with duration of middle 80% in days.

Yearling Chinook	10 %	50%	90 %	# of Days
1985[1]	9-May	20-May	1-Jun	24
1986	19-Apr	14-May	29-May	41
1987	3-May	16-May	1-Jun	30
1988	25-Apr	14-May	1-Jun	38
1989	3-May	16-May	28-May	26
1990	26-Apr	11-May	22-May	27
1991[1]	26-Apr	19-May	7-Jun	43
1992	3-May	20-May	10-Jun	39
1993	6-May	20-May	1-Jun	27
1994	2-May	22-May	18-Jun	48
1995	29-Apr	14-May	19-May	21
1996	21-Apr	8-May	28-May	38
1997	20-Apr	4-May	28-May	39
1998	28-Apr	16-May	2-Jun	36
1999	22-Apr	13-May	31-May	40
2000	20-Apr	9-May	28-May	39
2001	6-May	27-May	20-Jun	46
MEDIAN	28-Apr	16-May	1-Jun	35
MIN	19-Apr	4-May	19-May	21
MAX	9-May	27-May	20-Jun	48

Subyearling Chinook	10 %	50%	90 %	# of Days
1985[1]	12-Jul	22-Jul	5-Aug	25
1986	9-Jun	22-Jul	24-Aug	77
1987	7-Jun	23-Jul	18-Sep	104
1988	22-Jun	20-Jul	8-Sep	79
1989	8-Jun	19-Jul	16-Aug	70
1990	19-Jun	30-Jun	2-Aug	45
1991[1]	7-Jun	18-Jul	16-Aug	71
1992	25-Jun	18-Jul	15-Aug	52
1993	21-Jun	10-Jul	17-Aug	58
1994	8-Jul	22-Jul	2-Aug	26
1995	8-Jun	30-Jun	24-Jul	47
1996	12-Jun	9-Jul	19-Aug	69
1997	1-Jun	2-Jul	16-Aug	77
1998	11-Jun	30-Jun	29-Jul	49
1999	18-Jun	29-Jun	25-Jul	38
2000	6-Jun	29-Jun	3-Aug	59
2001	27-Jun	30-Jul	22-Aug	57
MEDIAN	12-Jun	18-Jul	16-Aug	66
MIN	1-Jun	29-Jun	24-Jul	25
MAX	12-Jul	30-Jul	18-Sep	104

Unclipped Steelhead	10 %	50%	90 %	# of Days
1985[1]	6-May	22-May	4-Jun	30
1986	26-Apr	18-May	4-Jun	40
1987	1-May	16-May	29-May	29
1988	26-Apr	15-May	3-Jun	39
1989	24-Apr	15-May	28-May	35
1990[1, 2]	26-Apr	4-May	18-May	23
1991	29-Apr	19-May	29-May	31
1992	23-Apr	10-May	25-May	33
1993	30-Apr	17-May	26-May	27
1994	27-Apr	19-May	26-May	30
1995	3-May	12-May	25-May	23
1996	24-Apr	13-May	24-May	31
1997	23-Apr	1-May	24-May	32
1998	27-Apr	9-May	29-May	33
1999	26-Apr	23-May	5-Jun	41
2000	18-Apr	5-May	28-May	41
2001	28-Apr	5-May	30-May	33
MEDIAN	26-Apr	15-May	28-May	33
MIN	18-Apr	1-May	18-May	23
MAX	6-May	23-May	5-Jun	41

Clipped Steelhead	10 %	50%	90 %	# of Days
1985[1]	ALL STEELHEAD IN UNCLIPPED			
1986				
1987				
1988				
1989				
1990[1,2]	3-May	14-May	25-May	23
1991	5-May	20-May	30-May	26
1992	8-May	19-May	29-May	22
1993	10-May	18-May	26-May	17
1994	9-May	24-May	1-Jun	24
1995	7-May	18-May	26-May	20
1996	28-Apr	16-May	27-May	30
1997	27-Apr	12-May	26-May	30
1998	4-May	15-May	1-Jun	29
1999	29-Apr	28-May	7-Jun	40
2000	15-Apr	2-May	24-May	40
2001	2-May	17-May	10-Jun	40
MEDIAN	3-May	17-May	28-May	26
MIN	15-Apr	2-May	24-May	17
MAX	10-May	28-May	10-Jun	40

Coho	10 %	50%	90 %	# of Days
1985[1]	7-Jun	16-Jun	26-Jun	20
1986	22-May	29-May	7-Jun	17
1987	6-May	13-May	31-May	26
1988	7-May	13-May	1-Jun	26
1989	28-Apr	13-May	29-May	32
1990[1]	28-Apr	5-May	20-May	23
1991	11-May	22-May	5-Jun	26
1992	3-May	13-May	27-May	25
1993	9-May	17-May	30-May	22
1994	12-May	18-May	29-May	18
1995	8-May	13-May	21-May	14
1996	27-Apr	8-May	21-May	25
1997	30-Apr	20-May	9-Jun	41
1998	10-May	22-May	2-Jun	24
1999	30-Apr	22-May	2-Jun	34
2000	5-May	13-May	8-Jun	35
2001	17-May	1-Jun	14-Aug	90
MEDIAN	7-May	17-May	1-Jun	26
MIN	27-Apr	5-May	20-May	14
MAX	7-Jun	16-Jun	14-Aug	41

Sockeye (Wild + Hatchery)	10 %	50%	90 %	# of Days
1985[1]	12-May	26-May	10-Jun	30
1986	4-May	23-May	5-Jun	33
1987	14-May	28-May	6-Jun	24
1988	13-May	22-May	4-Jun	23
1989	9-May	20-May	3-Jun	26
1990[1]	5-May	16-May	28-May	24
1991	17-May	23-May	1-Jun	16
1992	9-May	14-May	27-May	19
1993	16-May	21-May	31-May	16
1994	11-May	24-May	5-Jun	26
1995	9-May	19-May	26-May	18
1996	3-May	19-May	3-Jun	32
1997	10-May	25-May	21-Jun	43
1998	8-May	16-May	31-May	24
1999	10-May	17-May	1-Jun	23
2000	30-Apr	14-May	9-Jun	41
2001	1-Jun	14-Jun	27-Jun	27
MEDIAN	10-May	21-May	3-Jun	25
MIN	30-Apr	14-May	26-May	16
MAX	1-Jun	14-Jun	27-Jun	43

[1] Years in which the sample unit was out of service (1985: April 2 to April 26; 1990: May 30 to June 9).
[2] Unclipped and clipped steelhead were not differentiated before 1990.

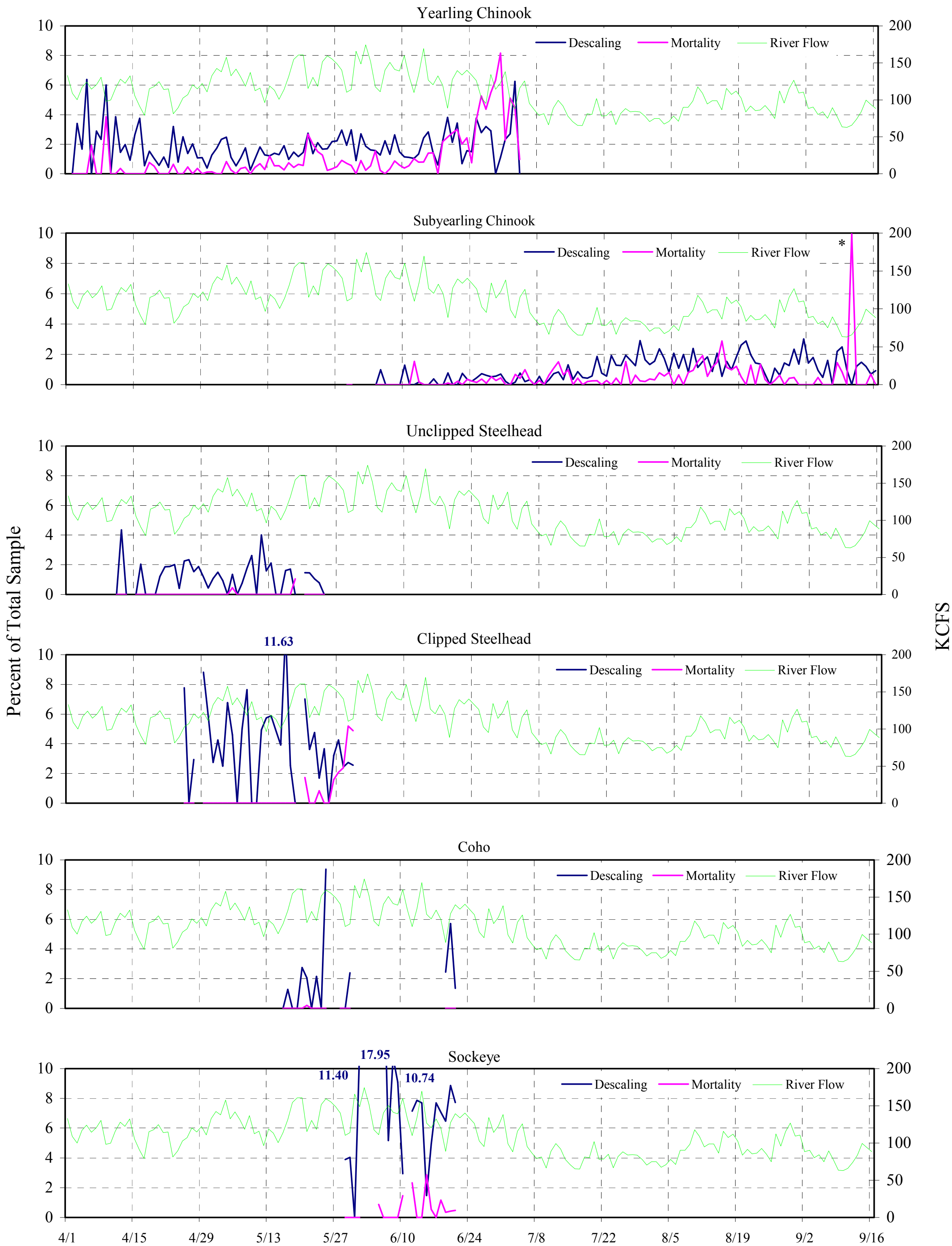


Figure A-3. John Day daily descaling, mortality, and river flow, 2001. Days with sample size of less than 30 have been excluded. * High mortality on 11 Sept. due to breach in protocol: recovery tank lid left open - 14 fish jumped out.

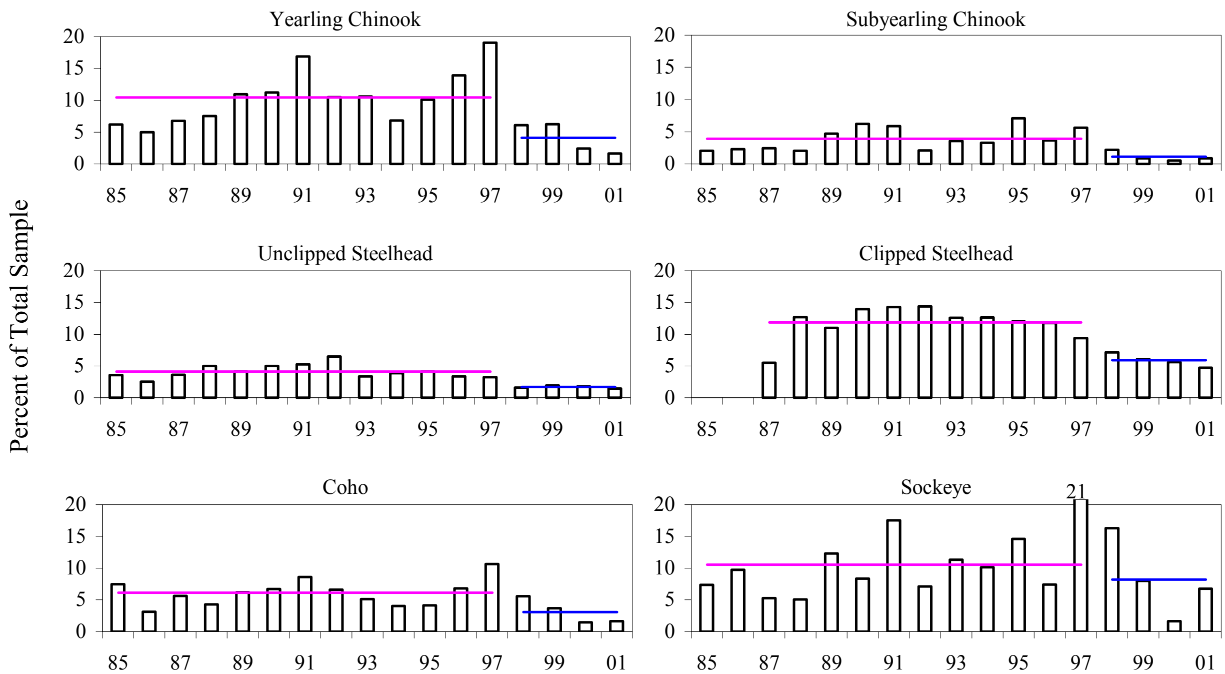


Figure A-4. John Day annual descaling rates, 1985-2001. Sampling switched from airlift pump system to new juvenile monitoring facility in 1998. Clipped and unclipped steelhead were not differentiated before 1987.

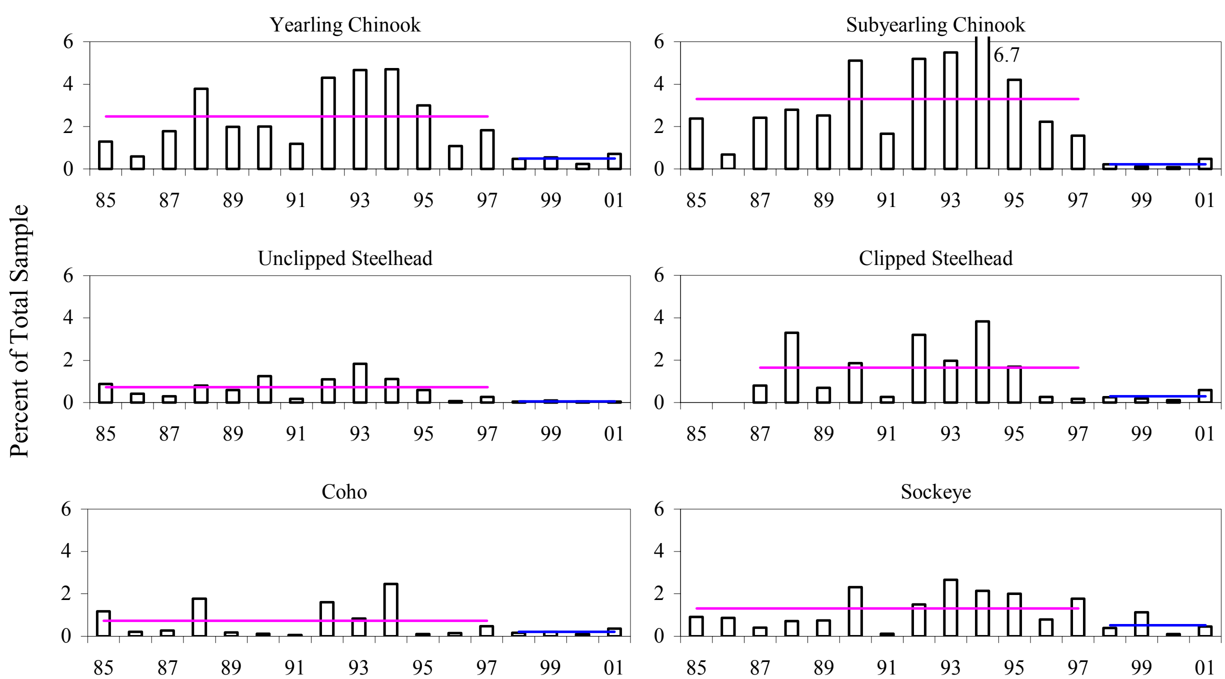


Figure A-5. John Day annual mortality rates, 1985-2001. Sampling switched from airlift pump system to new juvenile monitoring facility in 1998. Clipped and unclipped steelhead were not differentiated before 1987.

Table A-3. John Day annual descaling and mortality rates, 1985-2001.

	YEARLING CHINOOK						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1985	62,790	3,846	6.2		809	1.3	
1986	92,856	4,630	5.0		547	0.6	
1987	84,312	5,617	6.8		1,505	1.8	
1988	34,071	2,470	7.5		1,292	3.8	
1989	34,935	3,749	10.9		694	2.0	
1990	26,907	2,968	11.3		541	2.0	
1991	26,879	4,487	16.9		320	1.2	
1992	42,231	4,256	10.5		1,823	4.3	
1993	52,821	5,342	10.6		2,464	4.7	
1994	34,071	2,219	6.8		1,606	4.7	
1995	34,308	3,361	10.1		1,032	3.0	
1996	14,560	2,001	13.9		158	1.1	
1997	4,586	859	19.1	10.4	84	1.8	2.5
1998[1]	27,732	1,675	6.1		133	0.5	
1999[2]	160,378	9,952	6.2		882	0.5	
2000[2]	124,788	3,001	2.4		289	0.2	
2001	41,659	685	1.7	4.1	300	0.7	0.5
TOTAL	899,884	61,118	6.9		14,479	1.6	

	SUBYEARLING CHINOOK						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1985	228,211	4,567	2.0		5,425	2.4	
1986	181,857	4,135	2.3		1,231	0.7	
1987	95,693	2,290	2.5		2,313	2.4	
1988	109,435	2,186	2.1		3,050	2.8	
1989	129,957	5,922	4.7		3,273	2.5	
1990	39,280	2,316	6.2		2,009	5.1	
1991	46,785	2,696	5.9		775	1.7	
1992	59,783	1,216	2.1		3,096	5.2	
1993	116,804	3,954	3.6		6,413	5.5	
1994	75,164	2,309	3.3		5,004	6.7	
1995	48,896	3,325	7.1		2,029	4.2	
1996	31,157	1,119	3.7		692	2.2	
1997	20,487	1,133	5.6	3.9	322	1.6	3.3
1998[1]	31,178	678	2.2		70	0.2	
1999[2]	232,131	2,094	0.9		282	0.1	
2000[2]	197,340	1,102	0.6		186	0.1	
2001	40,215	355	0.9	1.1	189	0.5	0.2
TOTAL	1,684,373	41,397	2.5		36,359	2.2	

	UNCLIPPED STEELHEAD						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1985	36,355	1,292	3.6		320	0.9	
1986	37,858	962	2.6		156	0.4	
1987	12,374	447	3.6		41	0.3	
1988	6,810	335	5.0		56	0.8	
1989	8,585	348	4.1		53	0.6	
1990	6,104	303	5.0		76	1.2	
1991	5,455	287	5.3		10	0.2	
1992	5,141	332	6.5		54	1.1	
1993	16,042	530	3.4		294	1.8	
1994	7,604	290	3.9		85	1.1	
1995	4,043	166	4.1		26	0.6	
1996	3,973	134	3.4		3	0.1	
1997	4,011	130	3.3	4.1	11	0.3	0.7
1998[1]	8,378	132	1.6		4	0.0	
1999[2]	33,545	649	1.9		36	0.1	
2000[2]	44,416	789	1.8		26	0.1	
2001	7,567	109	1.4	1.7	3	0.0	0.1
TOTAL	248,261	7,235	2.9		1,254	0.5	

	CLIPPED STEELHEAD						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1985	All Steelhead in Unclipped						
1986							
1987	11,622	634	5.5		94	0.8	
1988	8,227	1,012	12.7		268	3.3	
1989	11,229	1,225	11.0		84	0.7	
1990	4,867	665	13.9		90	1.8	
1991	11,171	1,593	14.3		30	0.3	
1992	11,970	1,663	14.4		389	3.2	
1993	52,936	6,562	12.6		1,049	2.0	
1994	14,454	1,761	12.7		554	3.8	
1995	18,915	2,236	12.0		325	1.7	
1996	11,171	1,310	11.8		30	0.3	
1997	13,645	1,279	9.4	11.8	24	0.2	1.6
1998[1]	6,214	444	7.2		16	0.3	
1999[2]	42,003	2,537	6.1		83	0.2	
2000[2]	38,475	2,159	5.6		44	0.1	
2001	3,394	159	4.7	5.9	20	0.6	0.3
TOTAL	260,293	25,239	9.8		3,100	1.2	

	COHO						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1985	598	44	7.4		7	1.2	
1986	1,990	62	3.1		4	0.2	
1987	13,213	741	5.6		36	0.3	
1988	8,680	363	4.3		153	1.8	
1989	6,934	431	6.2		12	0.2	
1990	6,261	418	6.7		7	0.1	
1991	5,104	437	8.6		3	0.1	
1992	9,804	636	6.6		158	1.6	
1993	13,164	669	5.1		110	0.8	
1994	11,385	446	4.0		281	2.5	
1995	5,908	244	4.1		8	0.1	
1996	8,551	579	6.8		13	0.2	
1997	3,409	361	10.6	6.1	16	0.5	0.7
1998[1]	5,330	297	5.6		9	0.2	
1999[2]	37,941	1,397	3.7		78	0.2	
2000[2]	57,716	819	1.4		59	0.1	
2001	3,037	49	1.6	3.1	11	0.4	0.2
TOTAL	199,025	7,993	4.0		965	0.5	

	SOCKEYE						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1985	17,246	1,258	7.4		157	0.9	
1986	17,539	1,688	9.7		151	0.9	
1987	11,923	624	5.3		48	0.4	
1988	6,336	320	5.1		45	0.7	
1989	5,497	672	12.3		41	0.7	
1990	1,769	144	8.3		41	2.3	
1991	3,447	604	17.5		4	0.1	
1992	2,608	183	7.1		39	1.5	
1993	14,885	1,630	11.3		397	2.7	
1994	7,270	719	10.1		155	2.1	
1995	5,625	807	14.6		112	2.0	
1996	1,147	84	7.4		9	0.8	
1997	738	152	21.0	10.5	13	1.8	1.3
1998[1]	4,479	726	16.3		17	0.4	
1999[2]	54,710	4,331	8.0		619	1.1	
2000[2]	17,012	280	1.6		18	0.1	
2001	3,023	203	6.7	8.2	14	0.5	0.5
TOTAL	175,254	14,425	8.3		1,880	1.1	

[1] 1998 was the first season where samples were collected at the juvenile bypass facility.
[2] Sample size during these years was higher than normal to accommodate The Dalles Spillway Survival Study collection needs.

Table A-4. John Day condition subsampling data, 1985-2001, expressed as a percent of sample.

Yearling Chinook

YEAR	NO. SMPLD	INJURY HEAD	INJURY OPERC.	INJURY BODY	DISEASE PAR.	DISEASE COL.	DISEASE FUN.	DISEASE BKD	BIRD PRED	3-19% DESC
1985	981	0.9	N/A	1.9	0	N/A	0	0	0	10.2
1986	950	1.4	N/A	2.1	0	N/A	0	0	0	20.1
1987	1,957	0.4	N/A	1.1	0	N/A	0	0	0	15.9
1988	1,870	0.7	0.5	1.3	0.1	N/A	0.8	0	0.4	12.0
1989	1,313	1.7	1.1	3.1	0.5	N/A	0.8	0.4	0.5	13.0
1990	1,143	0.3	1.0	0.7	0.1	N/A	1.0	0.6	0.3	20.6
1991	1,959	0.7	0.3	0.5	0.2	N/A	0.6	0.7	1.6	14.3
1992	1,507	0.6	0.1	0.3	0.1	N/A	1.3	0.9	1.4	10.9
1993	3,995	N/A	3.0	0.8	0.4	0.3	0.4	N/A	1.1	15.5
1994	3,879	N/A	6.2	0.2	0.03	0.7	0.9	N/A	1.5	14.5
1995	2,573	2.2	2.9	1.6	1.5	0.3	1.7	2.6	2.4	21.5
1996	2,496	0.6	1.6	0.6	0.5	0.04	0.2	0.4	1.2	29.7
1997	1,509	0.4	2.3	0.4	1.2	0	0.3	0.7	1.6	17.3
1998	2,606	0.3	1.1	0.6	0.1	0.1	0.7	0.9	1.1	11.2
1999	2,753	0.3	1.6	0.7	0.4	0	0.8	0.7	1.2	15.7
2000	2,541	0.2	1.8	0.2	0.04	0.04	1.2	0.7	1.4	8.9
2001	3,955	0.1	0.9	0.1	0.4	0.1	0.3	1.0	1.9	6.6

Subyearling Chinook

YEAR	NO. SMPLD	INJURY HEAD	INJURY OPERC.	INJURY BODY	DISEASE PAR.	DISEASE COL.	DISEASE FUN.	DISEASE BKD	BIRD PRED	3-19% DESC
1985	2,707	1.8	N/A	1.6	0.04	N/A	0.9	0	0	7.4
1986	3,517	0.7	N/A	3.2	0	N/A	0.8	0	0	9.0
1987	4,407	0.3	N/A	3.4	0	N/A	0	0	0	11.6
1988	4,710	0.3	0.2	1.0	0	N/A	12.8	0	0.1	8.8
1989	2,997	0.2	0.2	0.3	0.2	N/A	3.8	0.1	0.3	9.7
1990	2,340	0.3	0.4	0.8	0.3	N/A	4.3	0.7	0	15.0
1991	3,106	0.4	0.1	0.6	0.2	N/A	4.2	0.1	0.03	9.0
1992	2,520	0.04	0.1	0.8	0.6	N/A	10.8	0.4	0.4	4.1
1993	5,869	N/A	3.1	0.2	0.3	8.6	2.2	N/A	0.12	10.4
1994	4,579	N/A	3.8	0.1	0.3	8.7	1.5	N/A	0.2	8.1
1995	4,392	0.3	2.4	0.3	0.8	2.9	0.3	0.9	0.4	8.1
1996	3,840	0.4	2.4	0.7	2.0	3.8	0.4	0.1	0.3	12.0
1997	5,380	0.7	1.6	0.2	0.2	0.9	0.1	0.1	0.3	8.1
1998	5,169	0.2	1.5	0.3	0.2	0.1	0.2	0.1	0.2	7.7
1999	8,767	0.1	1.4	0.4	0.1	0.1	0.1	0	0.3	4.8
2000	9,823	0.1	1.1	0.1	0.1	0.0	0.1	0.01	0.1	2.8
2001	9,588	0.1	1.1	0.2	0.02	0.03	0	0.2	0.1	8.1

Unclipped Steelhead

YEAR	NO. SMPLD	INJURY HEAD	INJURY OPERC.	INJURY BODY	DISEASE PAR.	DISEASE COL.	DISEASE FUN.	DISEASE BKD	BIRD PRED	3-19% DESC
1985	635	1.7	N/A	5.7	0	N/A	0	0	0	10.9
1986	1,022	1.9	N/A	3.4	0	N/A	0	0	0	21.3
1987	1,603	0.7	N/A	2.9	0	N/A	0	0	0	13.8
1988	1,758	1.5	0.9	3.5	1.6	N/A	2.0	0	1.4	12.3
1989	1,391	0.9	1.5	5.2	3.7	N/A	2.7	0	3.5	13.6
1990	476	0.4	0.8	0.2	2.1	N/A	1.5	0	1.3	14.7
1991	899	0.4	1.0	0.7	7.5	N/A	0	0.3	1.7	7.6
1992	863	0.1	0.6	1.2	3.0	N/A	0.6	0.2	1.7	6.6
1993	2,265	N/A	1.4	0.8	2.6	0.5	0.3	N/A	1.8	10.9
1994	1,605	N/A	2.9	0.2	2.2	0	1.4	N/A	2.6	8.7
1995	1,131	2.5	1.9	1.3	15.2	0.2	2.2	0.2	3.4	11.4
1996	1,126	0.9	1.8	1.2	3.5	0	0.3	0	2.5	18.1
1997	1,035	0.6	1.6	0.8	2.2	0	0.6	0.1	2.4	9.8
1998	1,707	0.2	0.4	0.1	2.4	0.1	0.2	0	1.8	3.6
1999	2,334	0.3	2.6	0.7	5.0	0	1.0	0.1	4.9	9.3
2000	2,304	0.04	1.6	0.04	2.5	0.04	0.4	0.1	2.7	10.1
2001	1,715	0.2	1.2	0.1	8.2	0	0.5	0	2.0	5.1

Clipped Steelhead

YEAR	NO. SMPLD	INJURY HEAD	INJURY OPERC.	INJURY BODY	DISEASE PAR.	DISEASE COL.	DISEASE FUN.	DISEASE BKD	BIRD PRED	3-19% DESC
1985	ALL STEELHEAD IN UNCLIPPED									
1986										
1987										
1988										
1989										
1990	507	1.0	1.2	3.6	1.2	N/A	1.8	0	3.2	24.5
1991	1,063	1.0	1.2	1.5	0.4	N/A	0.5	0.1	4.6	25.7
1992	938	0.3	1.7	3.6	0.3	N/A	3.0	0	6.1	14.6
1993	2,371	N/A	5.7	3.6	0.9	0.3	2.0	N/A	6.5	36.9
1994	1,812	N/A	9.9	1.9	0.1	0.1	3.9	N/A	15.1	24.2
1995	2,243	4.5	4.9	6.6	7.1	0.1	4.5	0.1	15.1	30.6
1996	2,185	0.9	3.4	2.2	0.6	0.1	1.0	0	9.6	41.1
1997	2,049	1.2	2.8	2.5	0.5	0.05	0.7	0	7.2	18.9
1998	1,510	0.7	3.7	2.3	0.4	0.1	1.2	0.1	7.6	12.8
1999	2,716	0.6	4.3	2.4	0.1	0.04	1.3	0.04	8.4	19.3
2000	1,990	0.4	3.1	0.7	0.7	0.1	0.9	0	6.9	18.3
2001	1,043	0.6	2.2	0.4	2.8	0	2.4	0	7.3	13.0

Coho

YEAR	NO. SMPLD	INJURY HEAD	INJURY OPERC.	INJURY BODY	DISEASE PAR.	DISEASE COL.	DISEASE FUN.	DISEASE BKD	BIRD PRED	3-19% DESC
1985	96	2.1	N/A	2.1	0	N/A	0	0	0	7.3
1986	230	1.3	N/A	3.5	0	N/A	0	0	0	8.3
1987	750	0.1	N/A	0.9	0	N/A	0	0	0	11.9
1988	1,080	0.1	0	0.3	0.1	N/A	0.5	0	0.4	5.9
1989	1,159	0.1	0.3	1.0	0.2	N/A	0.2	0	0.7	6.5
1990	849	0	0	1.3	0	N/A	1.2	0	1.1	13.4
1991	844	0	0.2	0.4	0.1	N/A	0.1	0.1	0.5	14.3
1992	834	0.4	0	0.5	0	N/A	0.7	0	1.0	9.1
1993	2,166	N/A	0.9	0.5	0	0.2	0	N/A	1.4	8.4
1994	1,450	N/A	2.7	0.1	0.1	0.1	0.3	N/A	2.7	9.7
1995	1,026	0.4	0.4	0.1	0.3	0	0.2	0	3.8	10.2
1996	1,738	1.1	1.4	0.7	0.5	0	0.2	0	1.6	21.5
1997	1,070	0.7	0.9	0.4	0.7	0	0.7	0.2	3.0	15.0
1998	1,374	0.1	1.5	0.5	0	0.1	0.3	0.1	1.8	5.9
1999	2,767	0.2	1.3	0.5	0.4	0	0.4	0.2	1.5	11.7
2000	2,399	0.2	1.2	0.2	0.4	0	0.3	0.04	1.1	5.0
2001	591	0.2	0.8	0.2	0.2	0.3	0	0.2	1.0	3.9

Sockeye

YEAR	NO. SMPLD	INJURY HEAD	INJURY OPERC.	INJURY BODY	DISEASE PAR.	DISEASE COL.	DISEASE FUN.	DISEASE BKD	BIRD PRED	3-19% DESC
1985	553	0.2	N/A	0.2	0	N/A	0	0	0	9.4
1986	588	1.0	N/A	2.6	0	N/A	0	0	0	17.2
1987	740	0.4	N/A	0.8	0	N/A	0	0	0	17.3
1988	1,004	0.2	0.4	0.1	0	N/A	0.4	0	0	6.1
1989	1,013	0.6	0.6	0.4	0	N/A	0.4	0.2	0	10.4
1990	361	0	0.3	0	0	N/A	0.8	0	0	10.2
1991	549	1.5	0.9	0.2	0	N/A	0.2	0.2	0.5	9.5
1992	291	1.0	0.3	0.7	0	N/A	0	0	0	12.7
1993	1,766	N/A	2.1	1.4	0.1	0	0.5	N/A	0.2	14.8
1994	1,656	N/A	2.1	0.5	0	0.1	0.2	N/A	0.5	16.0
1995	1,103	0.9	1.2	1.9	0	0	0.3	0.3	1.0	16.4
1996	399	0	0.3	1.3	0.3	0	0.3	0	0.5	20.3
1997	219	0.5	0.9	3.2	0.5	0	0.5	0	0.9	16.4
1998	1,268	0.1	0.5	1.4	0	0	0.2	0.1	0.1	15.5
1999	1,864	0.2	1.6	1.9	0	0	0.8	0.1	0.8	19.0
2000	1,463	0.8	0.9	0.8	0.1	0	0.2	0.1	0.1	6.9
2001	828	0	1.3	0.6	0	0.1	0.4	0.1	0.5	15.7

Table A-5. John Day PIT tag summary, 2001.

Migration Year	Species	Run	Rear	Observations	Species Totals	Migration Year Totals
2000	Chinook	Spring	Hatchery	1		
	Chinook	Spring	Wild	8		
	Chinook	Summer	Wild	10		
	Chinook	Fall	Hatchery	242		
	Chinook	Fall	Wild	6		
	Chinook	Unknown	Hatchery	8		
	Chinook	Unknown	Unknown	2		
	Chinook	Unknown	Wild	23	300 Chinook	
	Steelhead	Summer	Hatchery	6		
	Steelhead	Summer	Wild	33	39 Steelhead	**339**
2001	Chinook	Spring	Hatchery	11,266		
	Chinook	Spring	Wild	3,300		
	Chinook	Summer	Hatchery	38,291		
	Chinook	Summer	Wild	1,381		
	Chinook	Fall	Hatchery	9,104		
	Chinook	Fall	Unknown	9,385		
	Chinook	Fall	Wild	936		
	Chinook	Unknown	Hatchery	3,139		
	Chinook	Unknown	Unknown	448		
	Chinook	Unknown	Wild	233	77,483 Chinook	
	Coho	Fall	Hatchery	493		
	Coho	Fall	Unknown	71		
	Coho	Fall	Wild	6	570 Coho	
	Steelhead	Summer	Hatchery	1,141		
	Steelhead	Summer	Wild	539	1,680 Steelhead	
	Sockeye	Summer	Hatchery	13		
	Sockeye	Unknown	Hatchery	5		
	Sockeye	Unknown	Wild	187	205 Sockeye	
	Unknown	Unknown	Unknown	5	5 Unknown	**79,943**
			Total Observations at John Day:			**80,282**

Species Summary	Chinook	Coho	Steelhead	Sockeye	Unknown
Number	77,783	570	1,680	205	5
Percentage	96.9	0.7	2.1	0.3	0.0

Table A-6. John Day historical PIT tag detections, 1993-2001.

Species	Run	Rearing Type	1993 (3B, 3C)	1994 (3B)	1995 (3B)	1996 (3B, 3C)	1997 (3B)	1998	1999	2000	2001
								Full Bypass			
Chinook	Spring	Hatchery	199	205	267	677	66	8,528	21,928	4,420	11,267
		Wild	23	10	101	37	8	1,242	3,804	2,438	3,308
		Unknown								28	
	Summer	Hatchery	24	16	52	145	57	3,656	2,502	5,782	38,291
		Wild	4		20	40	4	832	3,024	1,023	1,391
		Unknown				1		1			
	Fall	Hatchery	4	3	52	187	38	12,174	7,046	4,375	9,346
		Wild	9	4	13	10	2	282	552	541	942
		Unknown						3	7,205	3,762	9,385
	Unknown	Hatchery	44	19	915	795	9	5,964	17,649	1,472	3,147
		Wild	17	4	253	182	1	1,190	3,948	3,331	256
		Unknown	15	14	28	215	5	3,340	5,748	254	450
Chinook Total			339	275	1,701	2,289	190	37,212	73,406	27,426	77,783
Steelhead	Spring	Hatchery				5					
		Wild							327		
	Summer	Hatchery	195	210	1,068	1,321	663	8,109	55,135	8,070	1,147
		Wild	62	26	115	141	61	2,510	4,106	5,390	572
		Unknown				1		10	18	1	
	Unknown	Hatchery						63			
Steelhead Total			257	236	1,183	1,468	724	10,692	59,586	13,461	1,719
Coho	Fall	Hatchery				5	9	652	4,433	780	493
		Wild								12	6
		Unknown						484	562	1	71
	Spring	Hatchery					3		1	22	
		Unknown								2	
	Unknown	Hatchery							1		
Coho Total						5	12	1,136	4,997	817	570
Sockeye	Spring	Hatchery	17		3						
	Summer	Hatchery				8		186	207	26	13
		Wild		5	1			16	30	7	
	Unknown	Hatchery				12	1	13	37		5
		Wild	19		9	2	1	355	442	43	187
		Unknown						4		47	
Sockeye Total			36	5	13	22	2	574	716	123	205
Unknown	Unknown	Wild						1			
		Unknown								21	5
Unknown Total								1		21	5
TOTALS (all species combined) =			**632**	**516**	**2,897**	**3,784**	**928**	**49,615**	**138,705**	**41,848**	**80,282**

Table A-7. John Day mark recapture data, 2001.

Species	Location	Color	Release River	Release Number	Number Recaptured	Collection Estimate
Yearling Fall Chinook	Left	Blue	Snake River	111,000	37	737
Yearling Spring Chinook	Left	Orange	Yakima River	123,000	150	4143
	Right	Orange	Yakima River	123,000	91	2647
	Right	Red	Yakima River	134,000	118	3093
Yearling Unknown Chinook	Left	Green	Clearwater R., Yakima R.	238,000	193	4842
	Left	Red	Snake River, Yakima R.	584000	1,151	24154
	Right	Green	Snake River, Yakima R.	226,000	149	3861
Summer Steelhead	Left	Green	Wenatchee River	58,250	12	289
	Left	Red	Wenatchee River	33,600	6	145
	Right	Green	Wenatchee River	48,100	8	445
	Right	Orange	Wenatchee River	45,500	4	480
			Total elastomer tags =	**1,724,450**	**1,919**	**44,836**

Freeze Brands

Species	Location*	Code	Orient.	Release Site	Release Number	Number Recaptured	Collection Estimate
Summer Steelhead	RA	S	1	Snake River	20000	3	35
				Total Freeze Brands =	**20000**	**3**	**35**

* RA = right anterior

Table A-8. John Day external mark recaptures, 1985-2001.

Year	Yearling Chinook	Subyearling Chinook	Unclipped Steelhead[1]	Clipped Steelhead	Coho	Sockeye	Total
Elastomer Tags							
1996	628						628
1997	201			135			336
1998	432			417			849
1999[2]	5,280			777			6,057
2000[2]	7,292			176			7,468
2001	1,889		30				1,919
Freeze Brands							
1985	1,960	80		2,113	3	334	4,490
1986	6,084	1,927		4,324	2	304	12,641
1987	1,890	1,024		1,608	4	107	4,633
1988	2,262	1,797		895	3	80	5,037
1989	2,207	1,585		2,150	1	36	5,979
1990	732	337		599	1	9	1,678
1991	576	773		1,134		85	2,568
1992[3]	1,420	945	66	546			2,977
1993[3]	1,069	1,920	24	1,463		39	4,515
1994	265	830		416			1,511
1995	560	317		183			1,060
1996	255	130		75	2		462
1997				16			16
1998				84			84
1999				55			55
2000				284			284
2001				3			3

[1] Unclipped and clipped steelhead were not differentiated before 1992.
[2] Large increase due to research collection needs.
[3] Samples from gatewells 3B and 3C combined.

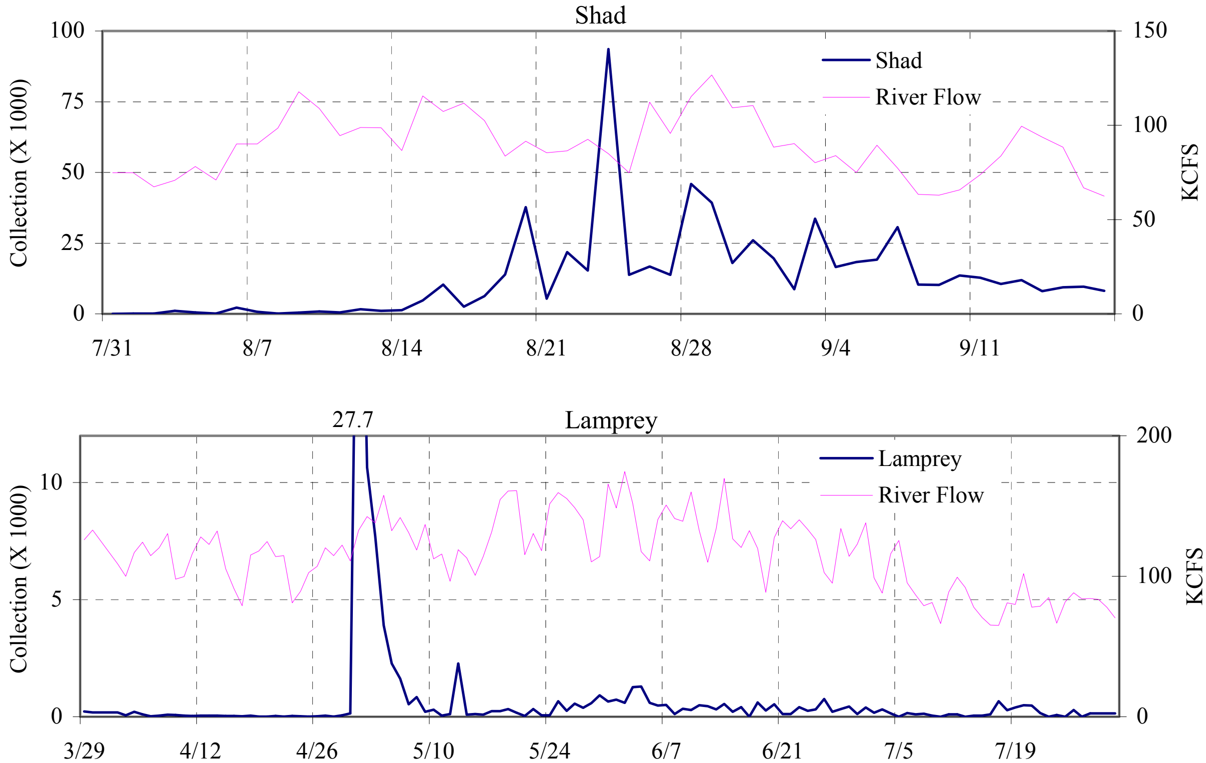


Figure A-6. John Day daily shad and lamprey passage, 2001.

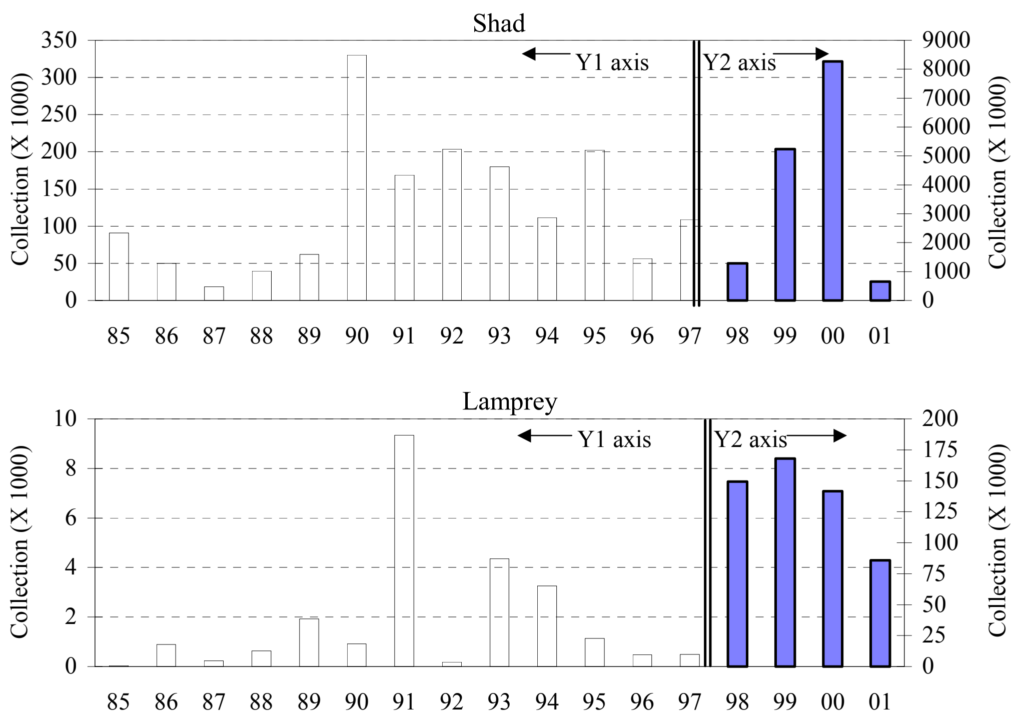


Figure A-7. John Day annual shad and lamprey collection totals, 1985-2001.

Table A-9. John Day collection numbers for incidental species, 1985-2001.

Year	American Shad Juvenile	American Shad Adult	Pacific Lamprey Juvenile	Pacific Lamprey Adult	Crappie Species	Sculpin Species	Mountain Whitefish	Sucker Species	Walleye	S-Mouth Bass	Bluegill[1]	Northern Squawfish	Peamouth	Chisel-mouth	Unknown Fallbacks[2]
1985	90,904	233	35	15	6,174	675	236	571	161	789	18	89	24	195	
1986	49,916	516	890	24	279	201	675	501	308	191	35	250	42	137	
1987	18,606	176	229	58	1,016	581	499	372	677	283	22	63	27	86	
1988	39,474	312	629	52	293	481	236	178	70	163	16	37	65	27	
1989	61,832	451	1,928	7	87	113	269	222	101	74	14	53	108	40	
1990[3]	330,177	213	923	4	96	48	253	92	24	60	1,054	17	25	25	
1991	168,602	179	9,337	44	99	59	383	162	12	79	159	646	14	16	
1992	203,782	175	178	6	38	4,827	444	64	813	119	44	9	32	14	
1993	180,088	615	4,348	7	58	256	582	295	133	93	237	56	26	11	
1994	111,418	460	3,250	28	28	479	353	234	167	68	8	16	104	25	
1995	202,375	772	1,143	36	81	29	294	142	84	115	102	41	200	34	
1996	56,245	657	481	10	8	23	303	137	28	38	27	18	28	14	
1997	108,961	50	486	3	20	11	79	291	4	16	18	3	6	8	
1998[4]	1,281,697	276	149,483	1,012	1,802	2,682	17,725	34,583	628	7,554	4,359	187	310	196	642
1999	5,234,523	939	167,856	493	281	1,050	8,294	6,761	1,347	1,586	2,320	236	117	2,050	9,725
2000	8,274,057	174	141,661	467	266	6,710	4,820	1,122	2,412	1,821	320	5	5	1,452	5,105
2001	648,522	628	85,717	586	59	200,362	14,541	2,744	4,197	3,422	525	0	12	0	4,685

[1] Bluegill and Pumpkinseeds are not differentiated.
[2] Data derived from a hinged gate at end of PDS designed to tally adult passage, including non-salmonids.
[3] Sampling was done in Gatewell 5B during the 1990 season, and an electrical fire shut down the unit from 29 May to 10 June.
[4] Starting in 1998, samples were collected using the full bypass system.

Table A-10. John Day PDS dewatering summaries, 1998-2001.

Date	Purpose/details	Adult Salmonids	P. Lamprey	Juvenile salmonids	Shad, cat-fish, other	Total
1998						
27-Jul-98	Scheduled inspection, Crest gate evaluation	69	100	30-50	138-258	337-477
23-Sep-98	PDS Adult holding investigation	130-140	50-100	200	22	402
29-Oct-98	End of season dewatering	164				164
1999						
2-Apr-99	PDS screen cleaner failure, switch gate repairs	2	20-30	50-60		72-92
9-Jun-99	Scheduled inspection, Crest gate malfunction	30-50				30-50
21-Sep-99	PDS Adult holding investigation	150-250	50-60		112	312-424
27-Oct-99	End of season dewatering	182	41		28	251
2000						
18-Sep-00	End of season dewatering	250	12	2	55	319
2001						
11-Jun-01	Scheduled inspection	45			255	300
23-Jul-01	Scheduled inspection	25			200	225
17-Sep-01	End of season dewatering	404			12	416

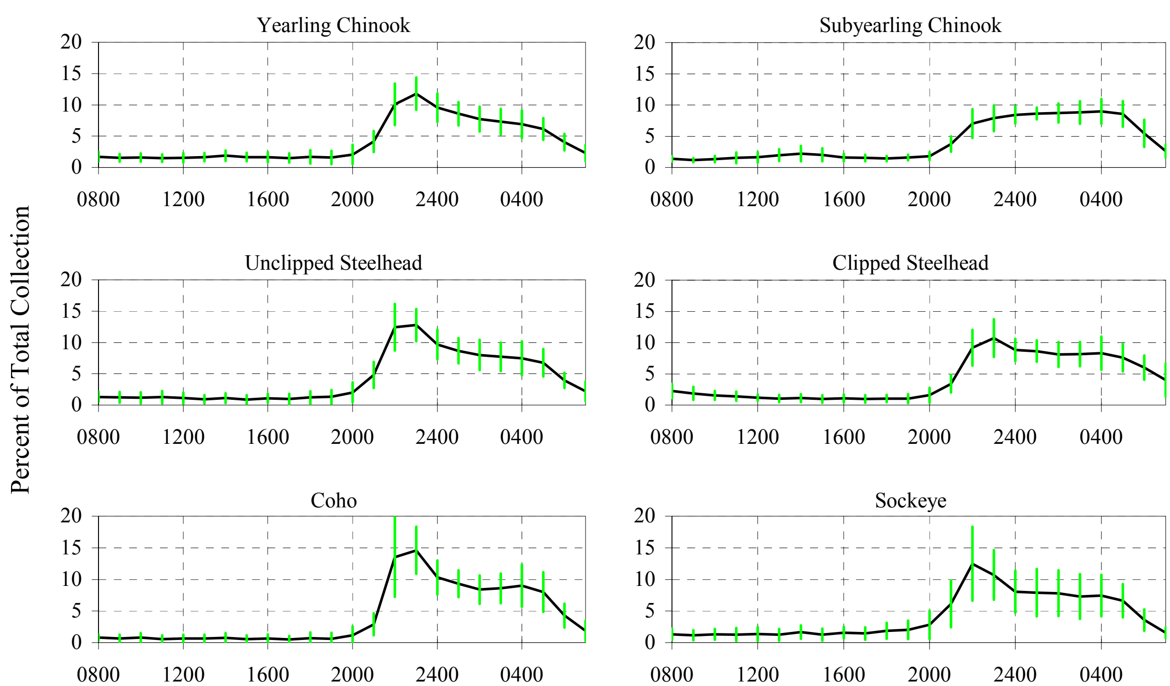


Figure A-8. John Day average diel passage with standard deviation, 1985-1997. Collection of hourly detail ceased in 1998 when sampling relocated to juvenile monitoring facility.

Table A-11. John Day percent of total passage per hour, 1985-1997. Collection of hourly detail ceased in 1998 when sampling relocated to juvenile monitoring facility.

Yearling Chinook

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	1.6	1.5	1.5	1.4	1.3	1.6	1.8	1.7	1.6	1.5	1.7	1.6	2.1	4.4	10.5	11.9	9.6	8.7	7.7	7.2	6.8	6.1	4.0	2.4
MIN	0.6	0.5	0.8	0.7	0.8	0.7	0.8	0.7	0.8	0.6	0.7	0.6	0.7	2.4	5.5	8.5	5.2	4.7	4.2	4.0	3.2	3.2	2.5	0.7
MAX	3.2	2.8	2.9	2.5	3.2	2.6	3.3	2.9	3.6	3.3	4.0	3.8	5.5	8.4	15.3	17.4	13.9	10.8	10.4	9.5	9.5	8.3	7.2	4.2

Subyearling Chinook

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	1.4	1.2	1.3	1.7	1.6	1.8	1.9	1.7	1.4	1.4	1.3	1.5	1.7	3.9	7.4	7.5	8.1	8.6	8.9	8.8	9.3	8.9	5.9	2.7
MIN	0.8	0.7	0.8	0.7	0.7	0.6	0.7	0.7	0.8	0.7	0.8	1.0	0.9	2.3	3.3	4.4	6.6	7.1	6.1	6.3	6.0	6.0	3.1	1.1
MAX	2.0	1.9	2.4	3.3	3.7	3.6	4.7	4.0	2.7	2.7	2.1	2.2	3.2	5.7	12.1	12.1	11.4	10.1	11.6	12.4	12.9	12.8	9.4	4.1

Unclipped Steelhead

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	1.4	1.3	1.2	1.3	1.1	0.9	1.1	0.9	1.1	1.0	1.3	1.4	2.2	4.7	12.8	12.8	9.4	8.6	7.7	7.4	7.2	6.5	4.2	2.5
MIN	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.2	0.1	0.3	2.1	8.1	8.7	5.4	5.3	4.3	4.4	3.9	3.6	2.1	0.4
MAX	2.9	3.0	2.9	3.1	2.9	2.2	2.6	2.3	2.6	2.6	3.5	3.2	5.2	7.3	18.0	16.1	13.7	12.4	12.6	11.1	12.0	10.7	6.1	5.5

Clipped Steelhead

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	2.5	2.3	1.5	1.4	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.8	3.4	9.6	10.8	8.8	8.4	7.8	7.7	7.5	7.1	6.2	4.8
MIN	0.5	0.2	0.6	0.1	0.4	0.2	0.5	0.1	0.4	0.1	0.6	0.2	0.3	1.1	6.0	6.6	6.5	6.5	5.1	5.2	4.4	4.5	3.1	0.7
MAX	3.8	4.2	3.1	2.3	2.1	2.1	2.6	2.0	2.2	2.2	2.5	2.7	4.1	6.4	13.8	16.2	12.0	12.7	12.0	11.5	11.4	11.6	9.8	9.7

Coho

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	0.9	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.6	0.5	0.8	0.7	1.3	2.7	14.7	14.7	9.4	8.8	7.5	7.9	8.4	8.0	5.0	2.9
MIN	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.5	5.0	10.4	5.7	5.0	5.4	5.4	4.9	4.7	1.5	0.3
MAX	1.7	2.1	2.3	2.1	2.3	2.1	2.5	2.0	2.1	1.9	3.5	3.4	5.2	6.2	25.0	22.2	16.7	13.4	13.4	12.0	15.3	13.6	7.9	5.6

Sockeye

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	1.0	1.1	1.1	1.1	1.1	1.2	1.4	1.2	1.4	1.4	1.9	2.1	2.7	6.1	14.4	12.4	8.1	7.8	7.4	6.9	7.0	6.2	3.5	1.5
MIN	0.3	0.2	0.2	0.3	0.3	0.2	0.4	0.3	0.4	0.3	0.3	0.2	0.4	1.1	4.9	7.3	3.8	3.7	2.4	2.4	3.0	2.7	2.1	0.6
MAX	3.0	3.0	3.3	4.3	4.4	3.8	3.7	3.5	3.5	3.4	4.2	4.2	7.3	13.5	24.3	22.6	14.0	14.5	13.6	13.0	12.1	10.3	8.0	3.2

All Species Combined

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	1.8	1.6	1.5	1.7	1.5	1.8	1.8	1.6	1.5	1.4	1.5	1.6	2.1	4.5	10.3	10.8	9.5	9.4	9.1	8.9	9.0	8.5	5.8	3.1
MIN	0.8	0.6	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.9	0.9	1.0	2.5	5.8	6.7	6.8	6.6	5.8	5.7	4.7	4.6	3.2	0.8
MAX	2.3	2.1	2.2	2.6	2.7	2.9	2.8	2.5	2.3	2.2	2.5	2.6	3.7	5.7	12.0	13.3	10.8	9.8	10.5	11.1	11.3	10.8	8.0	4.9

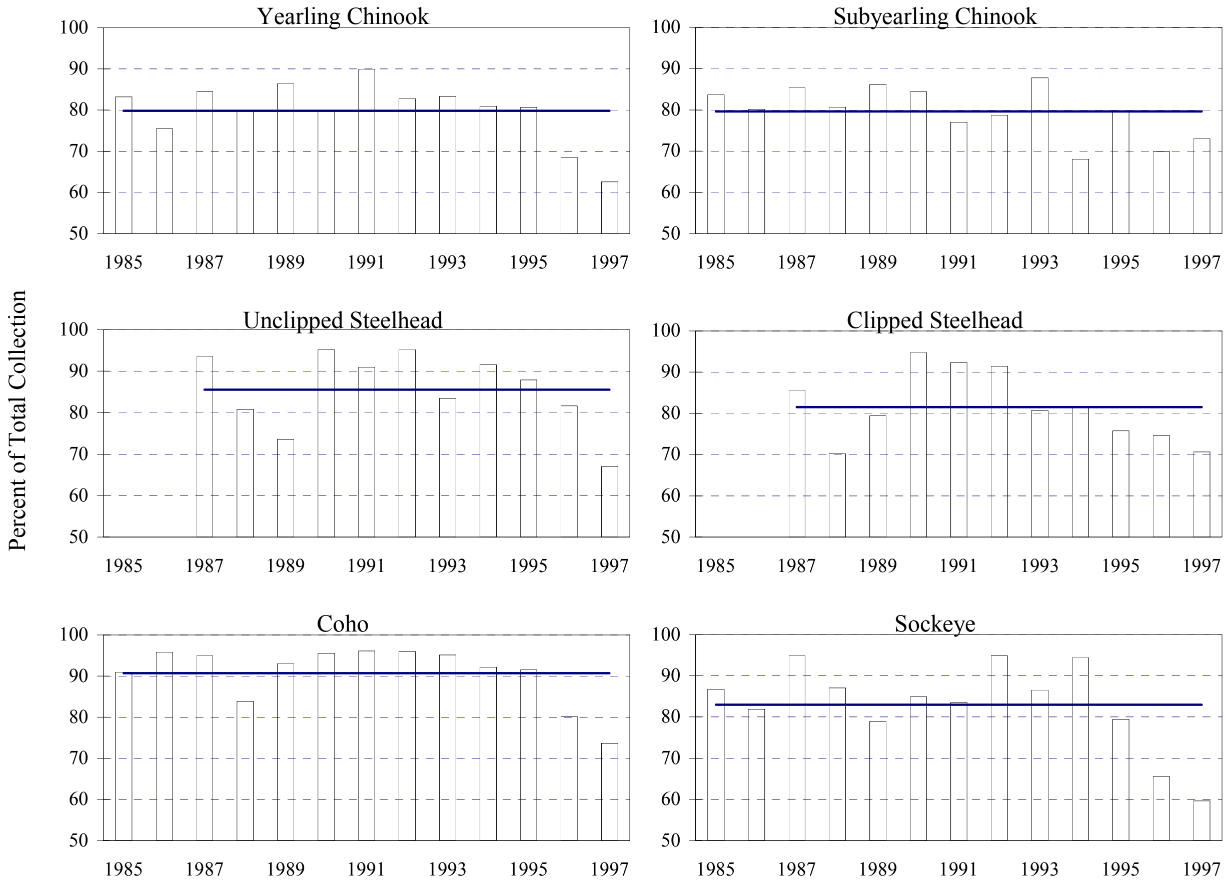


Figure A-9. John Day percent night passage (1800-0600 hours), 1985-1997, by species. Horizontal line is average for all years. Collection of hourly detail ceased in 1998 when sampling relocated to juvenile monitoring facility.

Table A-12. John Day percent night passage (1800-0600), 1985-1997. Collection of hourly detail ceased in 1998 when sampling relocated to juvenile monitoring facility.

YEAR	Yearling Chinook	Subyearling Chinook	Unclipped Steelhead	Clipped Steelhead	Coho	Sockeye	All Species Combined
1985	83.2	83.7	N/A	N/A	91.0	86.8	85.8
1986	75.5	80.1	N/A	N/A	95.9	81.9	82.6
1987	84.5	85.4	93.6	85.6	95.0	94.9	89.4
1988	80.0	80.7	80.8	70.3	83.9	87.1	80.4
1989	86.4	86.2	73.6	79.4	93.0	79.0	83.3
1990	79.7	84.4	76.3	94.8	95.6	85.0	88.5
1991	89.9	77.0	91.0	92.3	96.2	83.6	87.7
1992	82.8	78.7	95.3	91.5	96.0	94.9	88.9
1993	83.3	87.8	83.4	80.7	95.1	86.5	86.0
1994	80.9	68.1	91.6	81.4	92.2	94.5	83.3
1995	80.7	79.7	87.9	75.8	91.5	79.5	82.2
1996	68.6	70.0	81.6	74.7	80.2	65.6	73.4
1997	62.6	73.1	67.0	70.6	73.7	59.6	68.1
AVERAGE	79.8	79.6	83.8	81.5	90.7	83.0	83.0
MIN	62.6	68.1	67.0	70.3	73.7	59.6	68.1
MAX	89.9	87.8	95.3	94.8	96.2	94.9	89.4

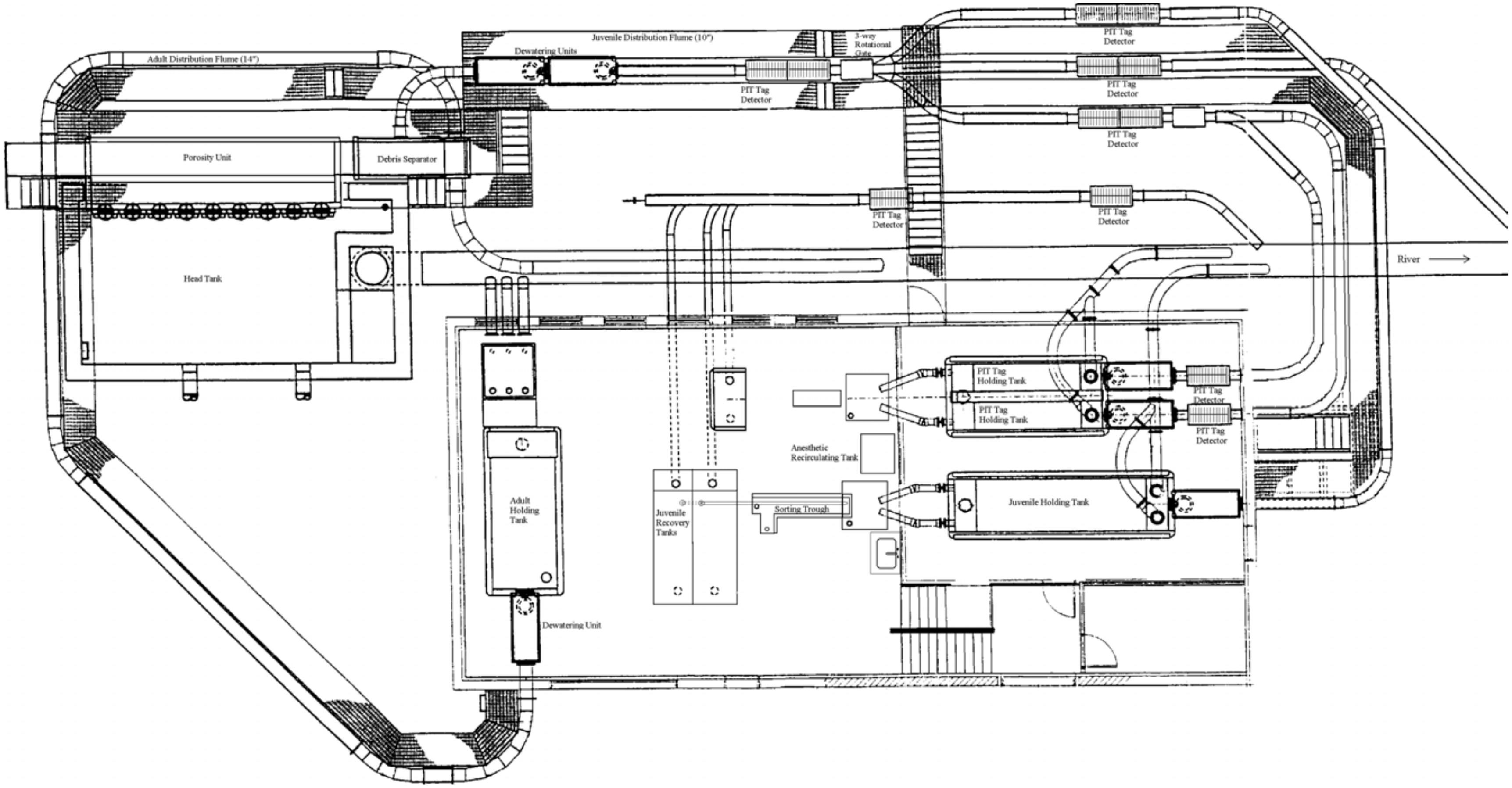


Figure A-10. John Day smolt monitoring facility laboratory layout, 1998-2001.

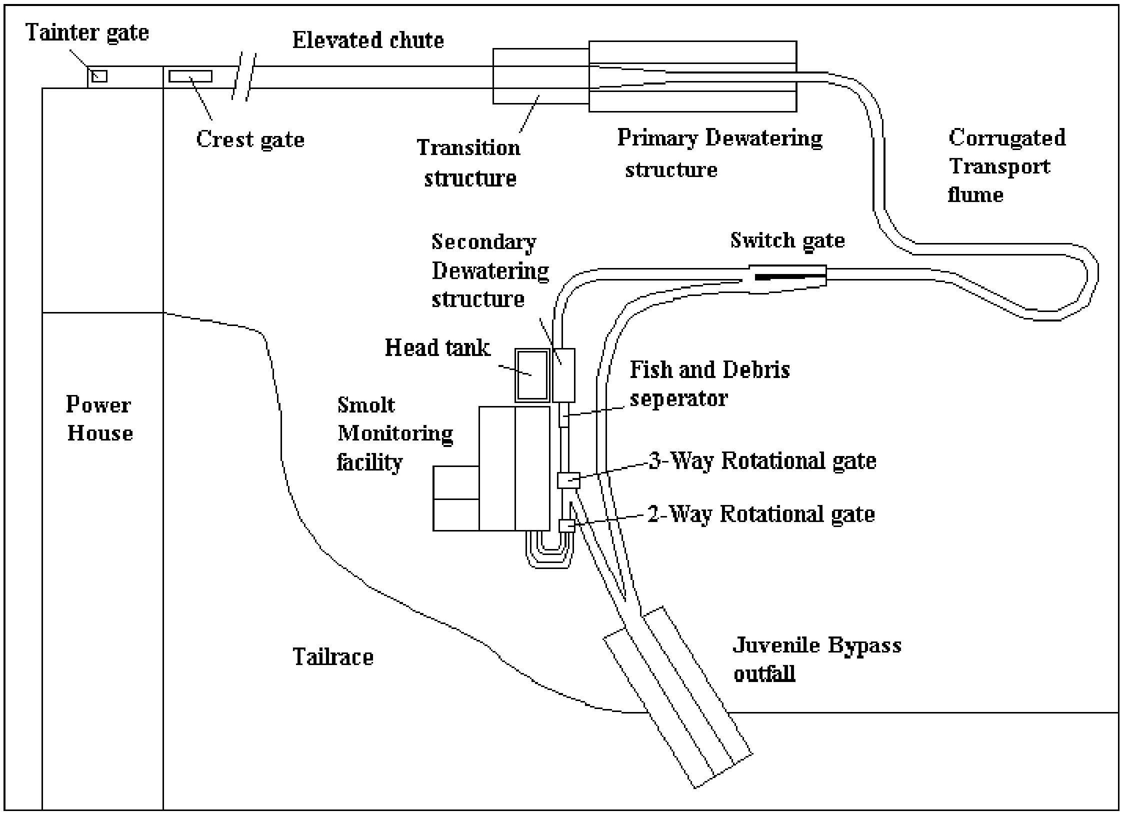


Figure A-11. John Day smolt monitoring facility "footprint", 1998-2001.

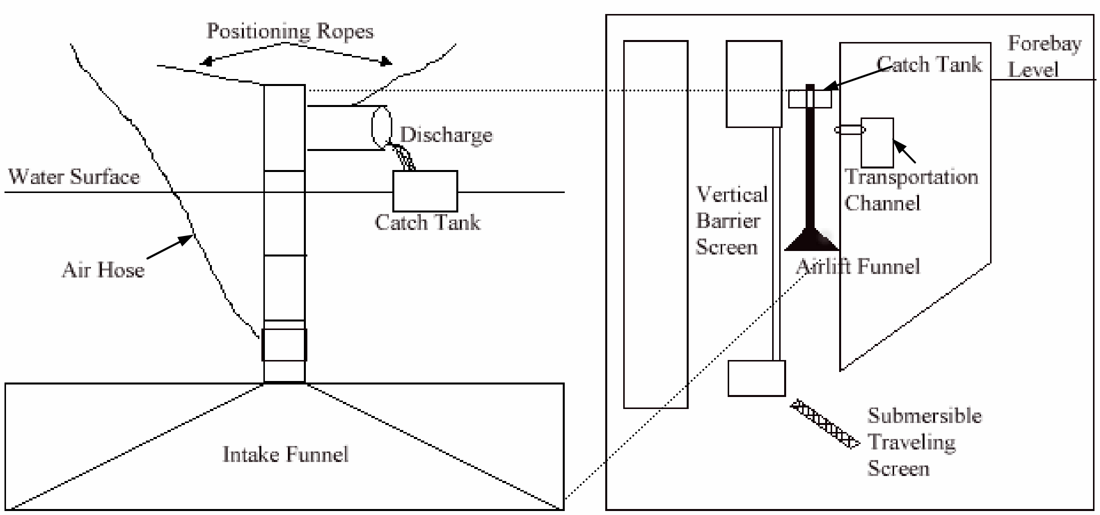


Figure A-12. John Day airlift sampling system , 1985-1997.

Table B-1. PH2 smolt monitoring program summary, 1986-2001.

		Sampling	Sub-	Sample	Yearling Chinook			Subyearling Chinook					Coho				
Year	Dates	Effort	Sampling	Rate (%)	Sample #	Collection	Index	Sample #[1]	Fry	Collection	Fry	Index	Sample #	Fry	Collection	Fry	Index
1986	3/4-11/25	24 / 7	NO	10	10,917			16,844					6,112				
1987	3/10-11/20	24 / 4	NO	10	6,461			5,438					3,940				
1988	3/17-11/30	24 / 7	NO	10	7,068			9,744					5,555				
1989	3/17-11/30	24 / 7	NO	10	15,579			12,197					9,192				
1990	3/12-11/30	24 / 7	NO	10	5,463			20,469					6,300				
1991	3/15-11/30	24 / 7	NO	10	18,372			19,050					8,070				
1992	3/13-11/20	≤ 7 / MWF	NO	10	358			1,461					119				
1993	3/17-11/24	≤ 24 / MWF	NO	10	5,468			5,545					3,621				
1994	3/10-10/31	≤ 24 / MWF	NO	10	4,172			5,703					2,678				
1995	3/11-10/31	≤ 24 / MWF	NO	10	2,709			4,696					1,075				
1996	3/13-9/13	≤ 24 / MWF	NO	10	3,059			8,662					4,296				
1997	4/27-9/5	≤ 24 / MWF	NO	100	1,311			7,415	648		N/A		2,169	0		N/A	
1998	4/1-10/2	≤ 24 / MWF	NO	100	3,355			5,519	316		N/A		1,303	18		N/A	
1999[2]	NA																
2000	3/8-10/31	24 / 7	YES	.67-25	17,337	809,700	2,539,355	19,683	1,118	1,130,109	18,790	3,814,964	11,596	6	619,676	40	1,977,601
2001	3/13-10/31	24 / 7	YES	.67-25	21,304	1,320,763	1,687,846	57,366	530	2,348,968	16,099	2,940,643	24,093	27	1,496,057	530	2,164,025

		Sampling	Sub-	Sample	Unclipped Steelhead			Clipped Steelhead[3]			Sockeye			Total		
Year	Dates	Effort	Sampling	Rate	Sample #	Collection	Index	Sample #	Collection	Index	Sample #	Collection	Index	Sample #	Collection	Index
1986	3/4-11/25	24 / 7	NO	10	1,494						2,599			37,966		
1987	3/10-11/20	24 / 4	NO	10	823						642			17,304		
1988	3/17-11/30	24 / 7	NO	10	762						238			23,367		
1989	3/17-11/30	24 / 7	NO	10	2,049						2,247			41,264		
1990	3/12-11/30	24 / 7	NO	10	238			205			164			32,839		
1991	3/15-11/30	24 / 7	NO	10	952			1,630			2,592			50,666		
1992	3/13-11/20	≤ 7 / MWF	NO	10	3			4			1			1,946		
1993	3/17-11/24	≤ 24 / MWF	NO	10	255			462			624			15,975		
1994	3/10-10/31	≤ 24 / MWF	NO	10	218			279			400			13,450		
1995	3/11-10/31	≤ 24 / MWF	NO	10	65			183			355			9,083		
1996	3/13-9/13	≤ 24 / MWF	NO	10	182			531			196			16,926		
1997	4/27-9/5	≤ 24 / MWF	NO	100	461			1,596			520			13,472		
1998	4/1-10/2	≤ 24 / MWF	NO	100	696			720			711			12,304		
1999[2]	NA															
2000	3/8-10/31	24 / 7	YES	.67-25	2,208	89,961	277,538	2,839	121,745	380,008	407	19,717	65,491	54,070	2,790,908	9,054,957
2001	3/13-10/31	24 / 7	YES	.67-25	2672	167,593	223,406	3,024	198,581	265,991	1,161	74,953	106,967	109,620	5,606,915	7,388,877

[1] Includes fry numbers.
[2] No sampling due to construction of new juvenile monitoring facility.
[3] Unclipped and clipped steelhead were not differentiated prior to 1990.

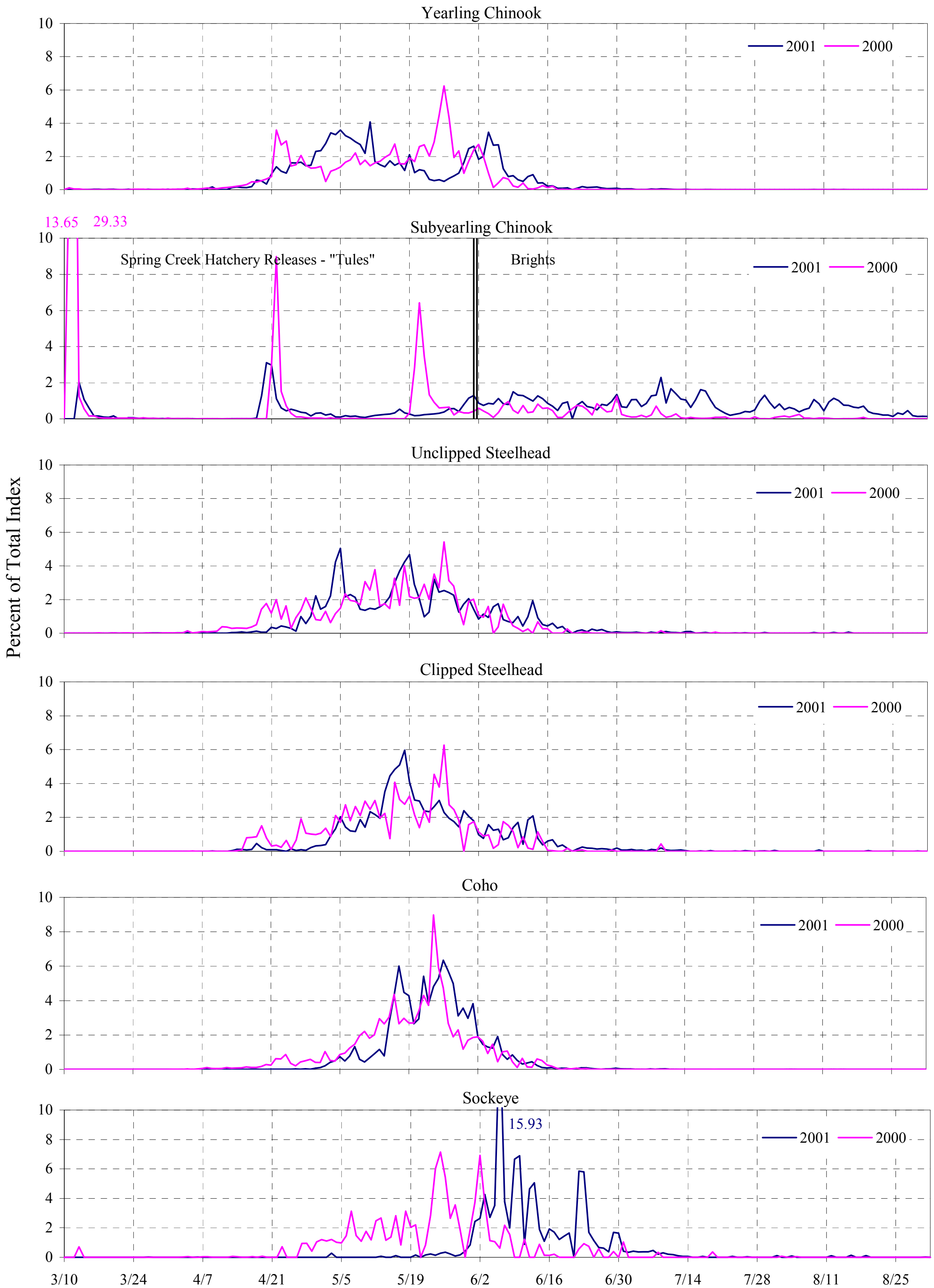


Figure B-1. PH2 daily passage for 2001 and 2000, expressed as a percent of passage.

APPENDIX B

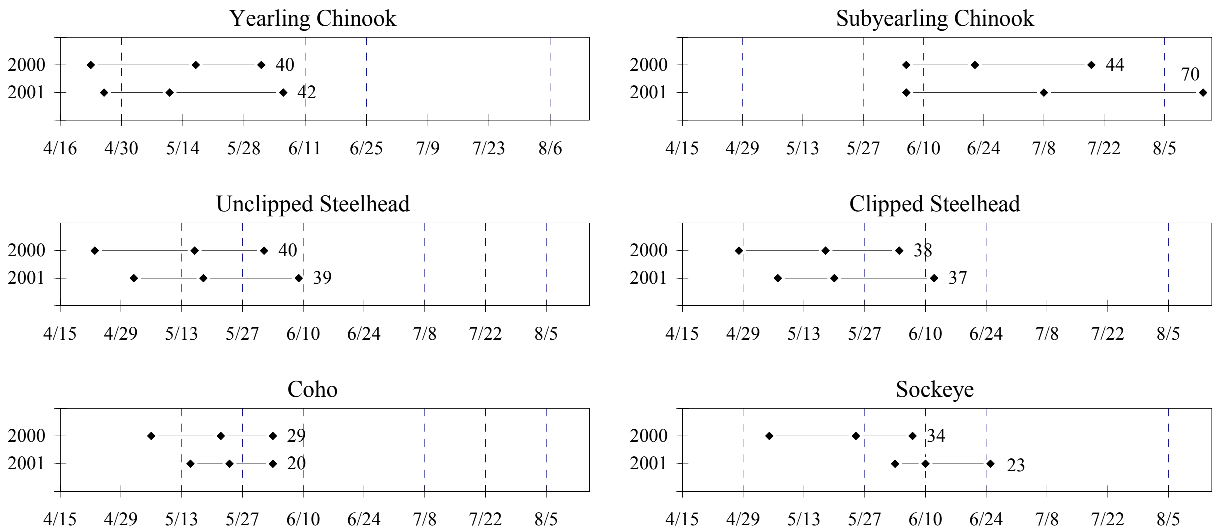


Figure B-2. PH2 10%, 50%, and 90% passage dates by species, 2000-2001. The duration between 10-90% dates (in days) is indicated for each year.

Table B-2. PH2 10%, 50%, and 90% passage dates for 2000-2001.

Yearling Chinook	10 %	50%	90 %	# of Days
2000	23-Apr	17-May	1-Jun	40
2001	26-Apr	11-May	6-Jun	42

Subyearling Chinook[1]	10 %	50%	90 %	# of Days
2000	6-Jun	22-Jun	19-Jul	44
2001	7-Jun	9-Jul	15-Aug	70

Unclipped Steelhead	10 %	50%	90 %	# of Days
2000	23-Apr	16-May	1-Jun	40
2001	2-May	18-May	9-Jun	39

Clipped Steelhead	10 %	50%	90 %	# of Days
2000	28-Apr	18-May	4-Jun	38
2001	7-May	20-May	12-Jun	37

Coho	10 %	50%	90 %	# of Days
2000	6-May	22-May	3-Jun	29
2001	15-May	24-May	3-Jun	20

Sockeye	10 %	50%	90 %	# of Days
2000	5-May	25-May	7-Jun	34
2001	3-Jun	10-Jun	25-Jun	23

[1] Only includes upriver Brights, to exclude the influence of Spring Creek hatchery fish (Tules).

Figure B-3. PH2 daily percent descaling, mortality, and river flow for 2001. Days with sample size less than 30 were excluded.

APPENDIX B

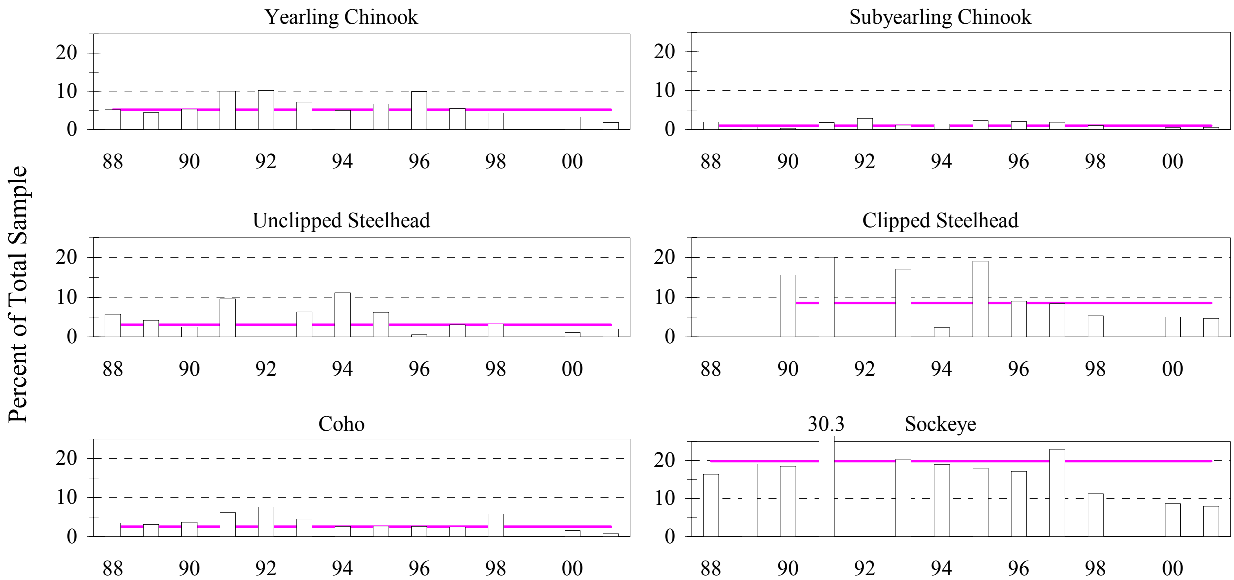


Figure B-4. PH2 annual descaling rate, 1988-2001, horizontal line is the average. Clipped and unclipped steelhead were not differentiated before 1990. No sampling conducted in 1999 due to construction.

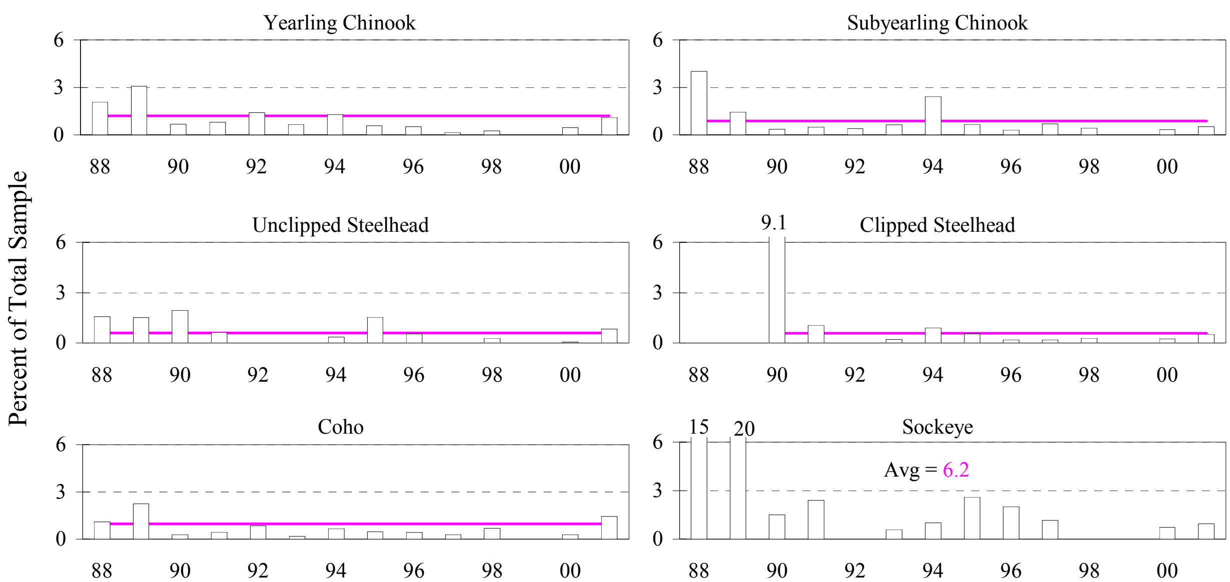


Figure B-5. PH2 annual mortality rate, 1988-2001, horizontal line is the average. Clipped and unclipped steelhead were not differentiated before 1990. No sampling conducted in 1999 due to construction.

Table B-3. PH2 annual descaling and mortality data, 1988-2001.

	YEARLING CHINOOK							SUBYEARLING CHINOOK						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1988	7,076	361	5.2		147	2.1		9,711	185	2.0		390	4.0	
1989	15,579	671	4.4		478	3.1		12,144	74	0.6		176	1.5	
1990	5,267	278	5.3		36	0.7		2,669	8	0.3		10	0.4	
1991	17,943	1,780	10.0		143	0.8		7,846	140	1.8		39	0.5	
1992	358	36	10.2		5	1.4		1,452	42	2.9		6	0.4	
1993	5,468	393	7.2		36	0.7		5,545	65	1.2		36	0.7	
1994	4,172	208	5.1		54	1.3		5,703	80	1.4		138	2.4	
1995	2,709	180	6.7		16	0.6		4,696	108	2.3		31	0.7	
1996	3,059	304	10.0		16	0.5		8,662	176	2.0		29	0.3	
1997	1,311	72	5.5		2	0.2		7,415	138	1.9		52	0.7	
1998	3,355	146	4.4	6.8	9	0.3	1.4	5,519	57	1.0	1.5	24	0.4	1.3
1999[1]														
2000[2]	17,337	576	3.3		80	0.5		19,683	101	0.5		68	0.3	
2001[2]	21,304	384	1.8	2.5	236	1.1	0.8	57,366	325	0.6	0.6	300	0.5	0.5
TOTAL	104,938	5,389	5.2		1258	1.2		148,411	1,499	1.0		1299	0.9	

	UNCLIPPED STEELHEAD							CLIPPED STEELHEAD						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1988	762	43	5.7		12	1.6		All Steelhead in Unclipped						
1989	2,049	84	4.2		31	1.5								
1990	206	5	2.5		4	1.9		176	25	15.6		16	9.1	
1991	921	88	9.6		6	0.7		1,614	321	20.1		17	1.1	
1992	3	0	0.0		0	0.0		4	0	0.0		0	0.0	
1993	255	16	6.3		0	0.0		462	79	17.1		1	0.2	
1994	279	31	11.2		1	0.4		218	5	2.3		2	0.9	
1995	65	4	6.3		1	1.5		184	35	19.1		1	0.5	
1996	182	1	0.6		1	0.5		531	48	9.1		1	0.2	
1997	461	14	3.0		0	0.0		1,596	134	8.4		3	0.2	
1998	695	23	3.3	5.3	2	0.3	1.0	720	38	5.3	12.5	2	0.3	0.8
1999[1]														
2000[2]	5,047	57	1.1		3	0.1		2,839	143	5.0		7	0.2	
2001[2]	2,672	53	2.0	1.4	22	0.8	0.3	3,024	140	4.7	4.8	16	0.5	0.4
TOTAL	13,597	419	3.1		83	0.6		11,368	968	8.6		66	0.6	

	COHO							SOCKEYE						
YEAR	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG	SAMPLE	DESC	%DESC	AVG	MORT	%MORT	AVG
1988	5,556	195	3.6		61	1.1		237	33	16.4		36	15.2	
1989	9,192	282	3.1		207	2.3		2,247	343	19.1		451	20.1	
1990	5,498	204	3.7		16	0.3		137	25	18.5		2	1.5	
1991	7,284	448	6.2		33	0.5		2,575	761	30.3		61	2.4	
1992	119	9	7.6		1	0.8		1	1	100.0		0	0.0	
1993	3,621	162	4.5		7	0.2		623	126	20.4		4	0.6	
1994	2,678	69	2.6		18	0.7		400	75	18.9		4	1.0	
1995	1,075	29	2.7		5	0.5		348	61	18.0		9	2.6	
1996	4,296	113	2.6		18	0.4		196	33	17.2		4	2.0	
1997	2,169	54	2.5		6	0.3		520	118	23.0		6	1.2	
1998	1,303	75	5.8	3.9	9	0.7	0.9	711	80	11.3	22.3	0	0.0	7.2
1999[1]														
2000[2]	11,596	182	1.6		33	0.3		407	35	8.7		3	0.7	
2001[2]	24,093	176	0.7	1.0	348	1.4	1.1	1,161	92	8.0	8.2	11	0.9	0.9
TOTAL	78,480	1,998	2.6		762	1.0		9,563	1,783	19.9		591	6.2	

[1] 1998 was the first season where samples were collected at the juvenile bypass facility.
[2] Sample size during these years was higher than normal to accommodate The Dalles Spillway Survival Study collection needs.

Table B-4. PH2 condition subsampling data, 2000-2001, expressed as a percent of total sample.

YEAR	NO. SMPLD	3-19% DESC	INJURY HEAD	INJURY OPERC.	INJURY BODY	DISEASE PAR.	DISEASE COL.	DISEASE FUN.	DISEASE BKD	BIRD PRED
Yearling Chinook										
2000	3375	18.28	0.12	0.47	0.80	0.30	0	0.65	0.21	1.45
2001	4368	14.54	0.27	0.57	0.66	0.25	0.00	4.08	0.85	1.76
Subyearling Chinook										
2000	3310	10.76	0.09	0.33	0.54	0.27	0	0.33	0.09	0.42
2001	11579	8.62	0.11	0.36	0.59	0.22	0.00	0.05	0.04	0.34
Unclipped Steelhead										
2000	868	19.35	0.46	0.23	0.46	5.88	0	0.35	0.12	2.88
2001	1051	15.13	0.00	1.05	0.67	11.80	0.00	0.38	0.00	3.33
Clipped Steelhead										
2000	1152	33.51	0.35	4.25	1.04	0.09	0	1.13	0	10.85
2001	1189	33.05	0.42	2.78	1.01	0.34	0.00	0.50	0.00	8.16
Coho										
2000	2788	10.72	0.07	0.22	0.36	0.14	0	0.93	0.04	0.90
2001	2136	11.00	0.23	0.51	0.61	0.14	0.00	0.94	0.05	0.89
Sockeye										
2000	192	34.38	0	1.56	0.52	0	0	0	0	0.52
2001	422	36.02	0.47	2.13	0.47	0.24	0.00	0.24	0.00	0.47

Table B-5. Bonneville PIT tag summary, 2001.

Migration		**Chinook**										
		Hatchery				Unknown			Wild			
Year	Site	FA	SP	SU	UN	FA	SP	UN	FA	SP	SU	UN
1999	B2J											
	BVX											
Total 1999												
2000	B2J	92			1			3	1	12	12	4
	BVX	1										
Total 2000		**93**			**1**			**3**	**1**	**12**	**12**	**4**
2001	B2J	2,071	12,551	18,220	2,282	3,402	1,847	102	140	1,745	1,344	240
	BVX	279	173	89	9	19			1	46	7	3
Total 2001		**2,350**	**12,724**	**18,309**	**2,291**	**3,421**	**1,847**	**102**	**141**	**1,791**	**1,351**	**243**
Season	B2J	2,163	12,551	18,220	2,283	3,402	1,847	105	141	1,757	1,356	244
Total	BVX	280	173	89	9	19			1	46	7	3
Totals		**2,443**	**12,724**	**18,309**	**2,292**	**3,421**	**1,847**	**105**	**142**	**1,803**	**1,363**	**247**

Migration		**Steelhead**		**Sockeye**				**Coho**			
		Hatchery	Wild	Hatchery		Wild		Hatchery	Wild	Unknown	
Year	Site	SU	SU	SU	UN	SU	UN	FA	FA	FA	**Totals**
1999	B2J		1								1
	BVX										
Total 1999			**1**								**1**
2000	B2J	9	121					2			257
	BVX		1								2
Total 2000		**9**	**122**					**2**			**259**
2001	B2J	1,251	527	12	5	2	125	385	4	109	46,364
	BVX	249	3					3			881
Total 2001		**1,500**	**530**	**12**	**5**	**2**	**125**	**388**	**4**	**109**	**47,245**
Season	B2J	1,260	649	12	5	2	125	387	4	109	46,622
Total	BVX	249	4					3			883
Totals		**1,509**	**653**	**12**	**5**	**2**	**125**	**390**	**4**	**109**	**47,505**

Table B-6. Bonneville annual PIT tag detection totals, 1992-2001.

Species	Run	Rearing Type	1992	1993	1994	1995	1996[1]	1997[2]	1998	1999	2000	2001
Chinook	Spring	Hatchery	1	70	48	38	831	2,323	7,563	25,971	12,827	12,724
		Wild	1	13	5	13	60	127	832	12,860	2,495	1,803
		Unknown	4								18,041	1,847
	Summer	Hatchery		6	6	9	273	1,199	2,364	3,205	5,426	18,309
		Wild		1	2	5	43	75	604	2,114	1,553	1,363
		Unknown							1			
	Fall	Hatchery		1		20	140	1,608	5,024	3,934	2,064	2,443
		Wild		2	3	2	2	117	79	230	58	142
		Unknown	2					7,127	3,891	24,167	6,693	3,421
	Unknown	Hatchery	4	15	7	131	1,057	161	5,018	14,124	4,277	2,292
		Wild		6	2	60	180	2	1,033	2,846	5,445	247
		Unknown	5	9	4	2	223	78	1,883	3,102	192	105
Chinook Total			17	123	77	280	2,809	12,817	28,292	92,553	59,071	44,696
Steelhead	Spring	Hatchery					18			1		
		Wild								188		
	Summer	Hatchery		16	19	46	1,454	7,242	4,747	28,118	9,312	1,509
		Wild		5	4	3	200	423	1,482	3,136	7,934	653
		Unknown		1			2	8	5	1		
	Unknown	Hatchery							9			
Steelhead Total			0	22	23	49	1,674	7,673	6,243	31,444	17,246	2,162
Coho	Spring	Hatchery						102		1	9	
		Unknown								5,040	9,010	
	Summer	Unknown							1			
	Fall	Hatchery					13	76	269	1,333	698	390
		Wild									12	4
		Unknown							68	246	1	109
	Unknown	Hatchery							117	2		
		Unknown						4,789	7,796			
Coho Total							13	4,967	8,251	6,622	9,730	503
Sockeye	Spring	Hatchery		6								
	Summer	Hatchery					11	5	161	101	81	12
		Wild					2	1	12	10	7	2
		Unknown									635	
	Unknown	Hatchery	2		1		23	11	12	20	2	5
		Wild		4	4	1	16	33	158	248	20	125
		Unknown							2		21	
Sockeye Total			2	10	5	1	52	50	345	379	766	144
Unknown	Unknown	Unknown									29	
Unknown Total											29	
TOTALS (all detections combined) =			**25**	**155**	**105**	**330**	**4,548**	**25,507**	**43,131**	**130,998**	**86,842**	**47,505**

[1] Beginning in 1996, all PH1 flat plate detections added.
[2] Beginning in 1997, all PH2 full bypass detections added.

Table B-7. PH2 mark recapture data, 2001.

Elastomer Tags

Species	Location	Color	Release River	Release Number	Number Recaptured	Collection Estimate
Yearling Fall Chinook	Left	Blue	Snake River	111,000	4	250
Yearling Spring Chinook	Left	Orange	Yakama River	123,000	38	2,645
	Right	Orange	Yakama River	123, 000	12	2,865
	Right	Red	Yakama River	134,000	32	775
Yearling Unknown Chinook	Left	Green	Clearwater R., Yakama R.	238,000	44	3,020
	Left	Red	Snake R., Yakama R.	584,000	108	7,800
	Right	Green	Snake R., Yakama R.	226000	25	1,725
Summer Steelhead	Left	Green	Wenatchee River	58,250	25	1,135
	Left	Red	Wenatchee River	33,600	32	1,297
	Right	Green	Wenatchee River	48,100	8	470
	Right	Orange	Wenatchee River	45,500	3	175
				Total Elastomer Tags =	**318**	**22,157**

No freeze brands were observed in 2001.

Table B-8. Annual mark recapture data, 1988- 2001.

Year	Yearling Chinook		Subyearling Chinook		Unclipped Steelhead[1]		Clipped Steelhead		Coho		Sockeye		Total		Grand Total
	PH1	PH2	PH1	PH2	PH1	PH2	PH1	PH2	PH1	PH2	PH1	PH2	PH1	PH2	
Elastomer Tags															
1997	183	47					169	12					352	59	352
1998	58	38					161	4					219	42	219
1999	156						29						185	0	185
2000	71	278					14	29					85	307	85
2001	4	263						68					4	331	335
Freeze Brands															
1988	425	56	165	2			157	8	2	1	55	4	804	71	804
1989	521	247	364	24			443	51			16	4	1344	326	1,344
1990	286	23	189	27			218	9			6		699	59	699
1991	258	71	235	5			204	32	2		48	11	747	119	747
1992	220		212		18		40						490	0	490
1993	349	42	360	10	6		57	4			19	3	791	59	791
1994	55	7	187	20			27						269	27	269
1995	181		147				77						405	0	405
1996	55	36	44	12			59	4	1				159	52	211
1997							30	2					30	2	32
1998							7	1					7	1	8
1999							1						1	0	1
2000								11					0	11	0
2001													0	0	0

[1] Unclipped and clipped steelhead were not differentiated before 1992.

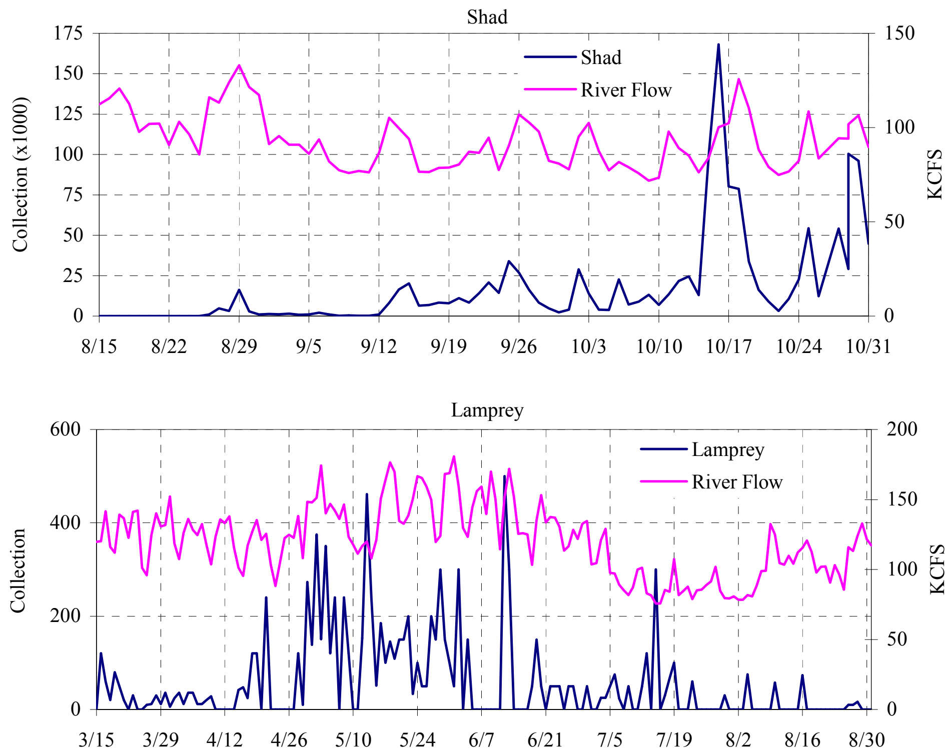
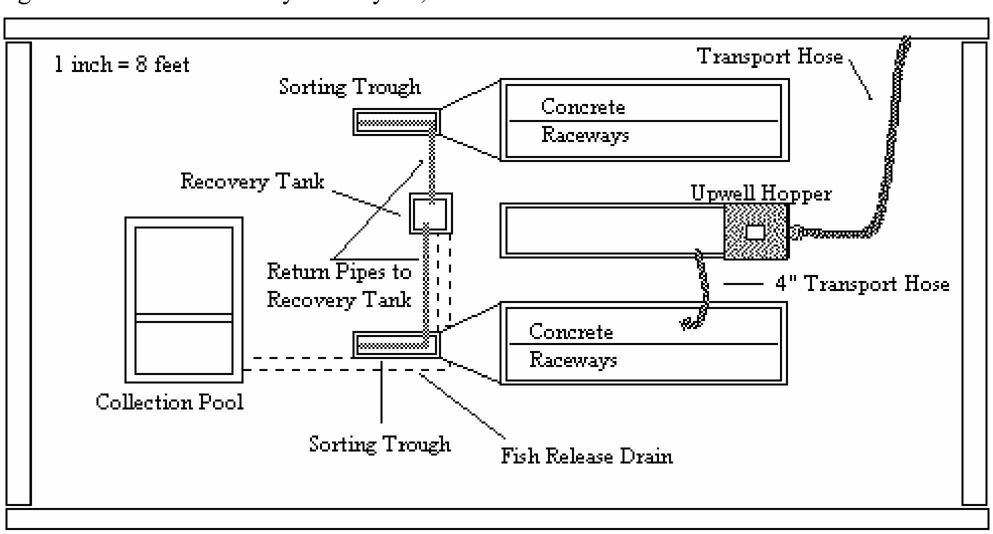


Figure B-6. PH2 daily shad and lamprey passage, 2001.

Table B-9. PH2 incidental collection summary, 2000-2001.

Year	American Shad		Pacific Lamprey				Northern	Redside	S-Mouth	Sculpin	Mountain
	Juvenile	Adult	Juvenile	Adult	Stickleback	Peamouth	Squawfish	Shiner	Bass	Species	Whitefish
2000	4,359,372	930	7,500	39	319	3,416	356	10	109	454	0
2001	1,376,845	1,385	9,635	100	71,718	8,972	1,282	106	180	99,853	276

Figure B-7. PH2 laboratory area layout, 1986-1998.



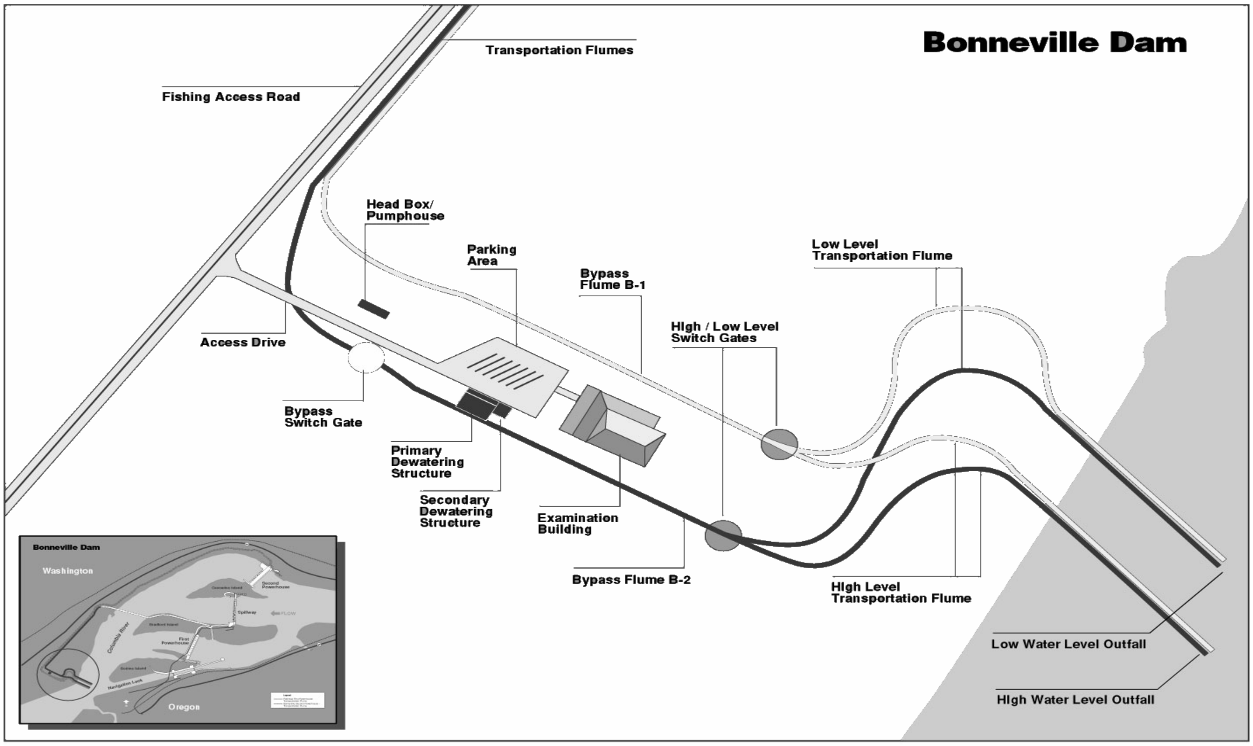


Figure B-8. Hamilton Island Juvenile Monitoring Facility, Bonneville Dam.

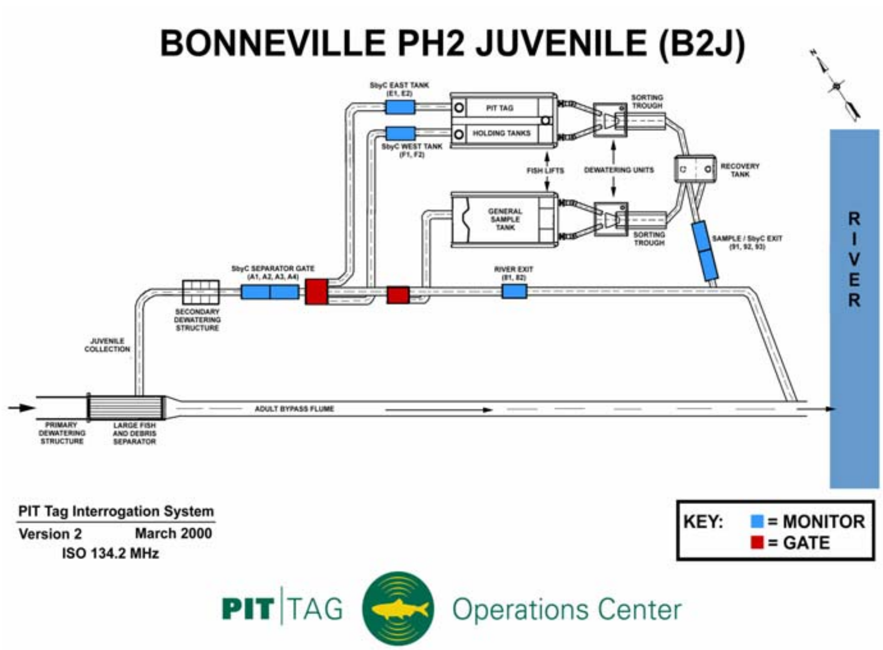


Figure B-9. Hamilton Island Juvenile Monitoring Facility schematic.

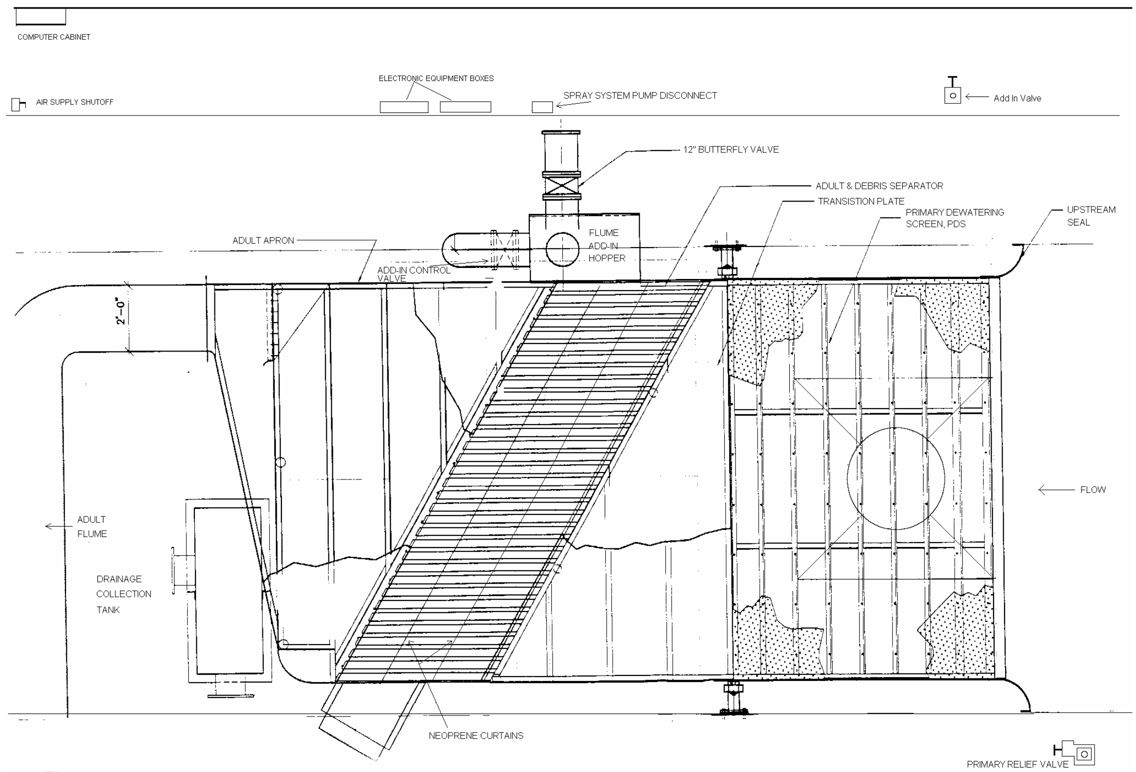


Figure B-10. PH2 PIT tag and sample collection system, top view, 1997-1998. This system was dismantled in 1999 to allow construction of new bypass at PH2.

APPENDIX B

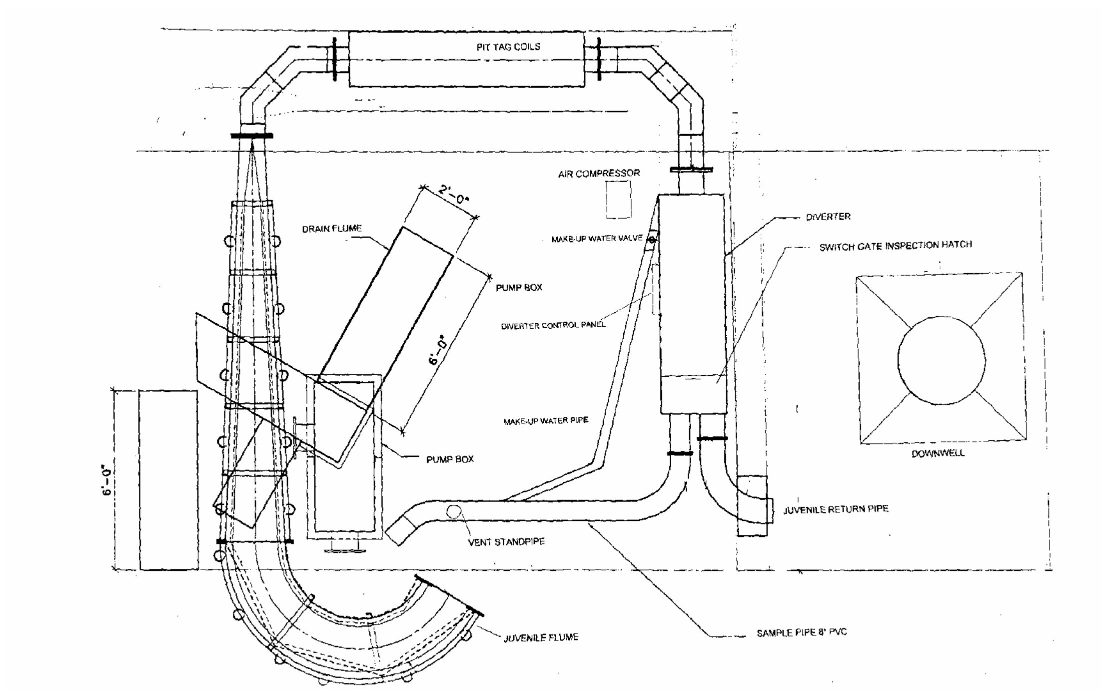


Figure B-11. PH2 PIT tag and collection system, lower level, 1997-1998. This system was dismantled in 1999 to allow construction of new bypass at PH2.

Table C-1. PH1 smolt monitoring program summary, 1986-2001.

		Sampling	Sub-	Sample	**Yearling Chinook**			**Subyearling Chinook**					**Coho**				
Year	Dates	Effort	Sampling	Rate	Sample #	Collection	Index	Sample #[1]	Fry	Collection[1]	Fry	Index	Sample #	Fry	Collection	Fry	Index
1986	5/12-11/26	8hr, 5 d/wk	YES	-	9,495	48,282	NA	23,252		86,220		NA	11,538		54,181		NA
1987	3/13-11/20	8hr, 5 d/wk	YES	-	28,828	120,108	NA	61,925		371,000		NA	23,188		102,228		NA
1988	3/15-11/30	8hr/day	YES	-	26,955	301,479	365,812	96,413		580,644		724,102	40,750		419,286		599,194
1989	3/15-11/30	8hr/day	YES	.1-.25	27,935	223,134	435,455	98,521		1,332,736		1,756,794	29,746		257,244		491,618
1990	3/12-11/30	8hr/day	YES	.0167-.2	23,843	196,216	332,792	80,422		658,702		1,219,778	43,030		365,826		677,413
1991	3/15-11/30	8hr/day	YES	.0167-.2	29,374	242,016	609,411	83,189		604,368		1,257,388	23,842		216,330		575,098
1992	3/13-11/20	24hr/day	YES	.0167-.2	42,523	284,983	723,655	112,037	2,742	882,211	15,165	2,320,423	23,971		140,403		388,809
1993	3/17-11/24	24hr/day	YES	.0167-.2	52,623	715,905	2,168,019	130,615	5,659	1,181,615	61,457	4,339,394	28,243		392,627		1,250,698
1994	3/10-10/31	24hr/day	YES	.0167-.2	34,362	248,741	779,713	125,967	1,538	1,360,832	14,731	3,607,383	22,378	72	201,310	459	626,443
1995	3/11-10/31	24hr/day	YES	.0167-.2	19,557	500,804	1,776,344	60,356	1,917	994,015	30,440	3,406,412	11,868	156	301,950	1,389	1,104,471
1996	3/11-10/31	8hr/day	YES	.0167-.2	7,825	77,780	360,961	29,556	79	432,364	647	1,593,073	13,076	9	156,957	97	675,605
1997	3/17-10/30	8hr/day	YES	.0167-.2	5,938	56,891	286,666	44,024	459	342,192	3,761	1,501,962	12,346	13	128,031	105	706,780
1998	3/9-10/31	8hr/day	YES	.00833-.25	6,850	97,581	346,281	30,835	510	450,650	8,116	1,591,883	6,272	28	121,695	452	513,643
1999	3/13-10/31	8hr/day	YES	.00833-.25	15,279	165,918	638,606	35,637	154	474,874	1,451	1,692,665	8,411	10	98,370	64	375,644
2000[2]	4/3-8/31	6-8hr/day	NO	-	5,104	-	-	7,477	18	-	-	-	2,452	5	-	-	-
2001[2]	4/3-8/31	6-8hr/day	NO	-	1,164	-	-	4,245	6	-	-	-	397	1	-	-	-

		Sampling	Sub-	Sample	**Unclipped Steelhead[3]**			**Clipped Steelhead**			**Sockeye**			**Total**		
Year	Dates	Effort	Sampling	Rate	Sample #	Collection	Index	Sample #	Collection	Index	Sample #	Collection	Index	Sample #	Collection	Index
1986	5/12-11/26	8hr, 5d/wk	YES	-	3,753	19,181	NA				2,883	14,350	NA	50,921	222,214	NA
1987	3/13-11/20	8hr, 5d/wk	YES	-	8,760	38,306	NA				4,079	18,733	NA	126,780	650,375	NA
1988	3/15-11/30	8hr/day	YES	-	7,473	75,662	103,701				4,587	52,023	77,921	176,178	1,429,094	1,870,730
1989	3/15-11/30	8hr/day	YES	.1-.25	12,240	106,787	206,226				7,723	72,962	138,310	176,165	1,992,863	3,028,403
1990	3/12-11/30	8hr/day	YES	.0167-.2	3,894	36,812	62,826	5,525	64,400	65,056	4,537	42,633	81,403	161,251	1,364,589	2,439,268
1991	3/15-11/30	8hr/day	YES	.0167-.2	2,775	26,295	74,438	5,504	54,528	155,754	4,462	47,722	147,174	149,146	1,191,259	2,819,263
1992	3/13-11/20	24hr/day	YES	.0167-.2	2,837	16,503	46,098	3,767	21,915	62,486	638	3,872	10,835	185,773	1,349,887	3,552,306
1993	3/17-11/24	24hr/day	YES	.0167-.2	4,025	74,138	226,120	7,456	185,240	563,884	4,939	178,245	538,837	227,901	2,727,770	9,086,952
1994	3/10-10/31	24hr/day	YES	.0167-.2	3,730	29,796	93,520	3,981	33,827	105,693	2,965	27,945	87,146	193,383	1,902,451	5,299,898
1995	3/11-10/31	24hr/day	YES	.0167-.2	1,240	29,963	106,889	3,737	103,508	376,571	2,184	71,990	263,680	98,942	2,002,230	7,034,367
1996	3/11-10/31	8hr/day	YES	.0167-.2	1,885	22,787	101,655	5,083	58,825	254,448	703	7,239	28,513	58,128	755,952	3,014,255
1997	3/17-10/30	8hr/day	YES	.0167-.2	3,615	38,829	205,873	9,285	105,516	575,077	589	5,765	31,099	75,797	677,224	3,307,458
1998	3/9-10/31	8hr/day	YES	.00833-.25	2,587	40,862	159,916	3,294	57,078	237,299	1,737	26,963	114,564	51,575	794,829	2,963,585
1999	3/13-10/31	8hr/day	YES	.00833-.25	2,549	94,322	108,164	5,647	65,488	65,488	2,118	33,100	118,203	69,641	866,584	3,176,429
2000[2]	4/3-8/31	6-8hr, 3d/wk	NO	-	1,314	-	-	1,378	-	-	223	-	-	17,948	-	-
2001[2]	4/3-8/31	6-8hr, 3d/wk	NO	-	91	-	-	25	-	-	9	-	-	5,931	-	-

[1] Includes fry numbers.
[2] Sampling reduced to condition monitoring only, collection and index estimates not available.
[3] Unclipped and clipped steelhead were not differentiated prior to 1990.

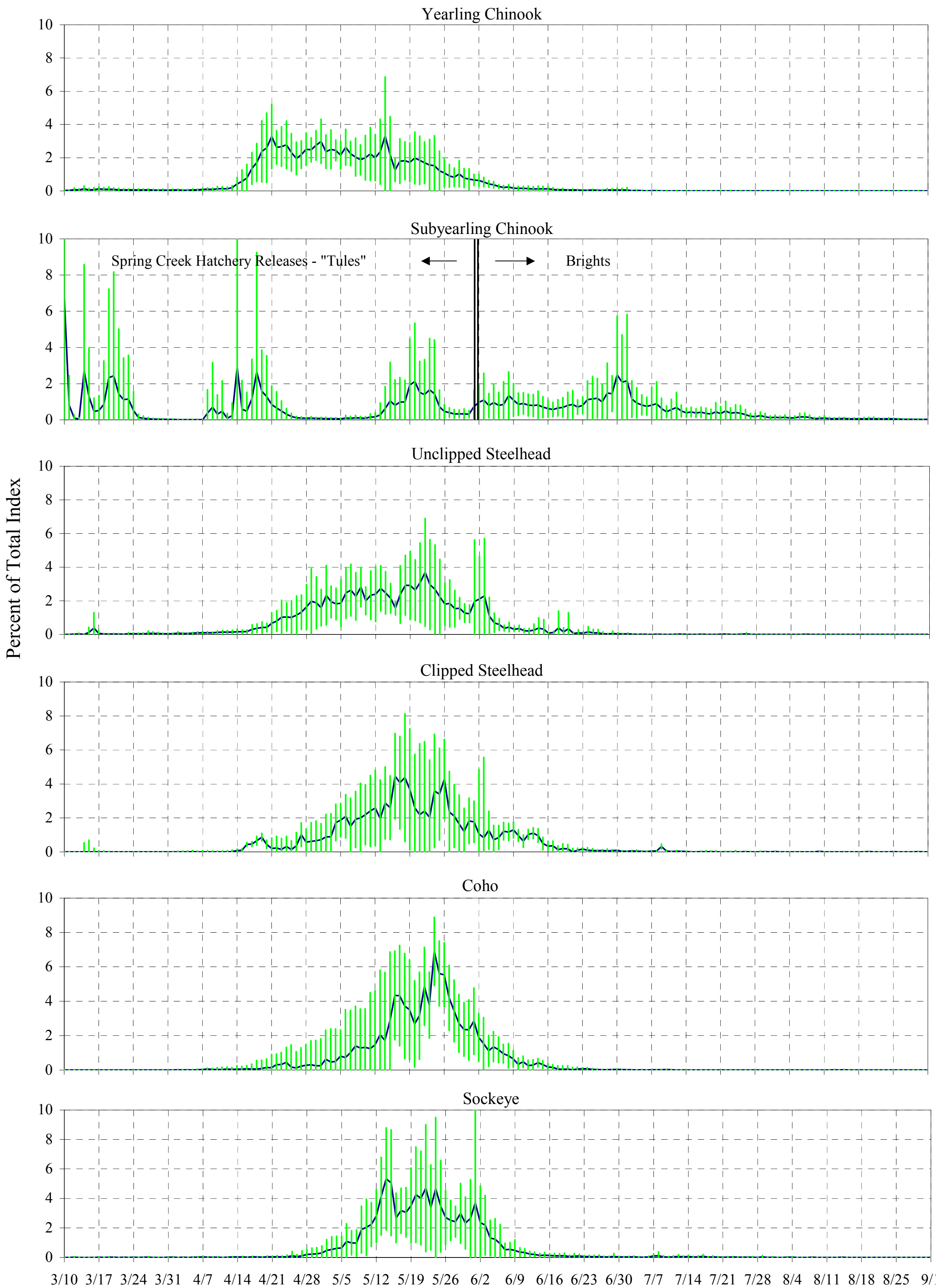


Figure C-1. PH1 average daily passage, 1987-1999, with the standard deviation expressed as a percent of total index.

APPENDIX C

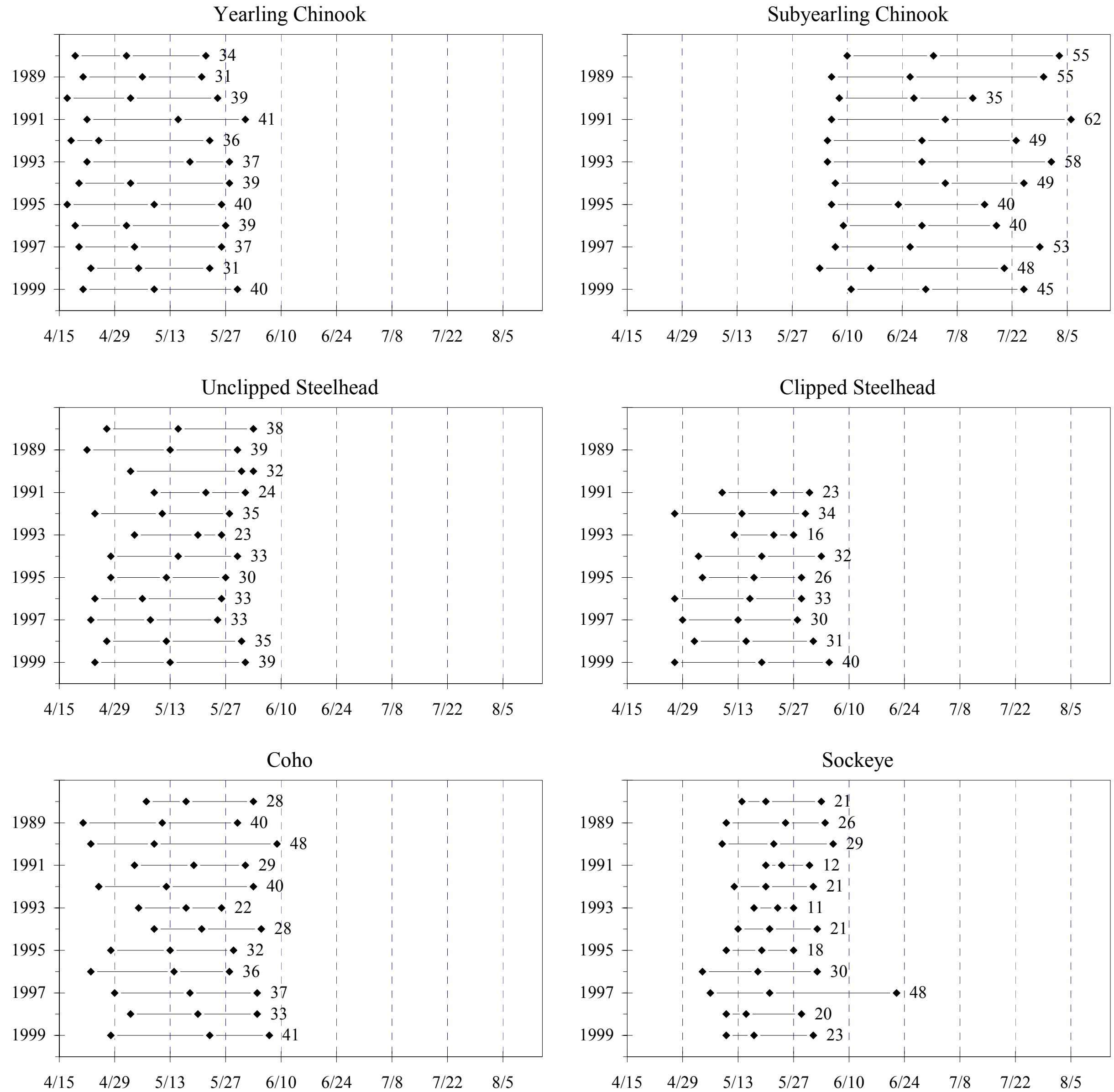


Figure C-2. PH1 10%, 50%, and 90% passage dates by species, 1988-1999. The duration between 10-90% dates (in days) is indicated for each year. Clipped and unclipped steelhead were not differentiated before 1991. Timing and duration calculations made only with PH2 data after 1999.

Table C-2. PH1 10%, 50%, and 90% passage dates for 1988-1999. This data collected at PH2 after 1999.

Yearling Chinook	10 %	50%	90 %	# of Days
1988	19-Apr	02-May	22-May	34
1989	21-Apr	06-May	21-May	31
1990	17-Apr	03-May	25-May	39
1991	22-Apr	15-May	01-Jun	41
1992	18-Apr	25-Apr	23-May	36
1993	22-Apr	18-May	28-May	37
1994	20-Apr	03-May	28-May	39
1995	17-Apr	09-May	26-May	40
1996	19-Apr	02-May	27-May	39
1997	20-Apr	4-May	26-May	37
1998	23-Apr	5-May	23-May	31
1999	21-Apr	9-May	30-May	40
MEDIAN	20-Apr	04-May	26-May	37
MIN	17-Apr	25-Apr	21-May	31
MAX	23-Apr	18-May	01-Jun	41

Subyearling Chinook - "Brights" Only	10 %	50%	90 %	# of Days
1988	10-Jun	02-Jul	03-Aug	55
1989	06-Jun	26-Jun	30-Jul	55
1990	08-Jun	27-Jun	12-Jul	35
1991	06-Jun	05-Jul	06-Aug	62
1992	05-Jun	29-Jun	23-Jul	49
1993	05-Jun	29-Jun	01-Aug	58
1994	07-Jun	05-Jul	25-Jul	49
1995	6-Jun	23-Jun	15-Jul	40
1996	9-Jun	29-Jun	18-Jul	40
1997	7-Jun	26-Jun	29-Jul	53
1998	3-Jun	16-Jun	20-Jul	48
1999	11-Jun	30-Jun	25-Jul	45
MEDIAN	06-Jun	29-Jun	25-Jul	50
MIN	03-Jun	16-Jun	12-Jul	35
MAX	11-Jun	05-Jul	06-Aug	62

Unclipped Steelhead[1]	10 %	50%	90 %	# of Days
1988	27-Apr	15-May	03-Jun	38
1989	22-Apr	13-May	30-May	39
1990	03-May	31-May	03-Jun	32
1991	09-May	22-May	01-Jun	24
1992	24-Apr	11-May	28-May	35
1993	04-May	20-May	26-May	23
1994	28-Apr	15-May	30-May	33
1995	28-Apr	12-May	27-May	30
1996	24-Apr	6-May	26-May	33
1997	23-Apr	8-May	25-May	33
1998	27-Apr	12-May	31-May	35
1999	24-Apr	13-May	1-Jun	39
MEDIAN	27-Apr	13-May	30-May	34
MIN	22-Apr	06-May	25-May	23
MAX	09-May	31-May	03-Jun	39

Clipped Steelhead[1]	10 %	50%	90 %	# of Days
1988				
1989				
1990				
1991	09-May	22-May	31-May	23
1992	27-Apr	14-May	30-May	34
1993	12-May	22-May	27-May	16
1994	03-May	19-May	03-Jun	32
1995	04-May	17-May	29-May	26
1996	27-Apr	16-May	29-May	33
1997	29-Apr	13-May	28-May	30
1998	2-May	15-May	1-Jun	31
1999	27-Apr	19-May	5-Jun	40
MEDIAN	02-May	17-May	30-May	29
MIN	27-Apr	13-May	27-May	16
MAX	12-May	22-May	05-Jun	40

Coho	10 %	50%	90 %	# of Days
1988	07-May	17-May	03-Jun	28
1989	21-Apr	11-May	30-May	40
1990	23-Apr	09-May	09-Jun	48
1991	04-May	19-May	01-Jun	29
1992	25-Apr	12-May	03-Jun	40
1993	05-May	17-May	26-May	22
1994	09-May	21-May	05-Jun	28
1995	28-Apr	13-May	29-May	32
1996	23-Apr	14-May	28-May	36
1997	29-Apr	18-May	4-Jun	37
1998	3-May	20-May	4-Jun	33
1999	28-Apr	23-May	7-Jun	41
MEDIAN	28-Apr	17-May	03-Jun	37
MIN	21-Apr	09-May	26-May	22
MAX	09-May	23-May	09-Jun	48

Sockeye (Wild + Hatchery)	10 %	50%	90 %	# of Days
1988	14-May	20-May	3-Jun	21
1989	10-May	25-May	4-Jun	26
1990	9-May	22-May	6-Jun	29
1991	20-May	24-May	31-May	12
1992	12-May	20-May	1-Jun	21
1993	17-May	23-May	27-May	11
1994	13-May	21-May	2-Jun	21
1995	10-May	19-May	27-May	18
1996	4-May	18-May	2-Jun	30
1997	6-May	21-May	22-Jun	48
1998	10-May	15-May	29-May	20
1999	10-May	17-May	1-Jun	23
MEDIAN	10-May	20-May	01-Jun	24
MIN	04-May	15-May	27-May	11
MAX	20-May	25-May	22-Jun	48

[1] Unclipped and clipped steelhead were not differentiated before 1991 for index purposes.

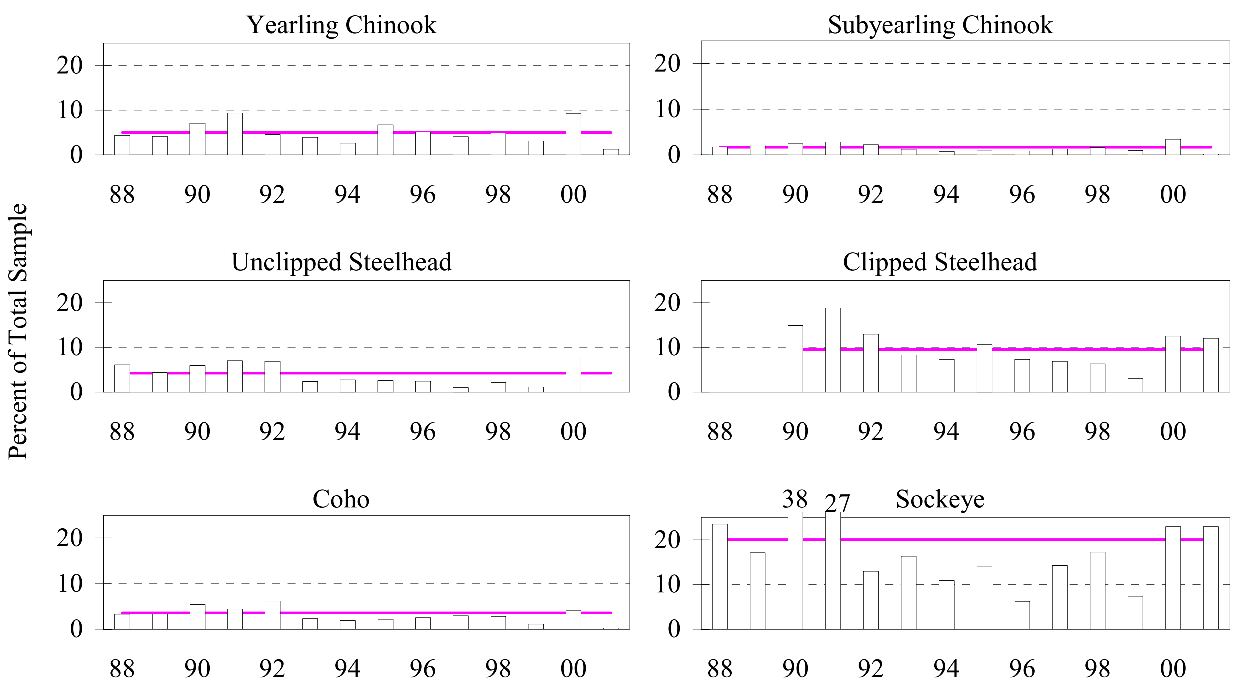


Figure C-3. PH1 annual descaling rate, 1988-2001, horizontal line is the average. Clipped and unclipped steelhead were not differentiated before 1990.

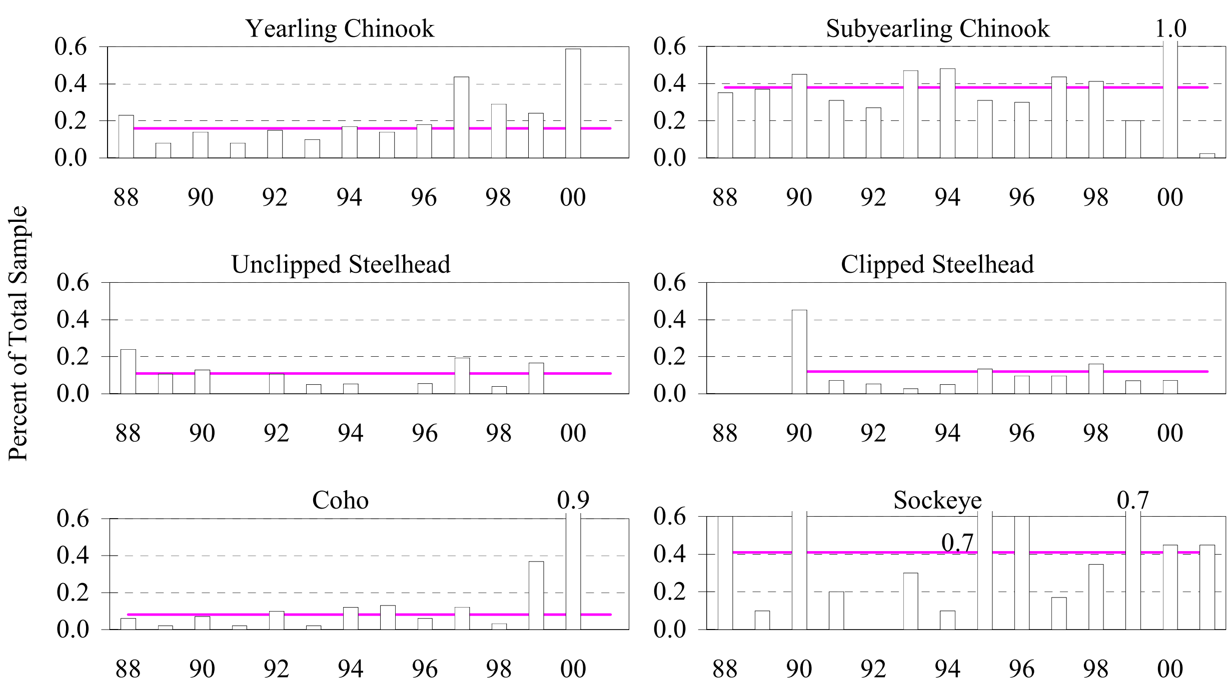


Figure C-4. PH1 annual mortality rate, 1988-2001, horizontal line is the average. Clipped and unclipped steelhead were not differentiated before 1990.

Table C-3. PH1 annual descaling and mortality data, 1988-2001.

	YEARLING CHINOOK					**SUBYEARLING CHINOOK**				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988	28,958	1,265	4.4	67	0.2	96,416	1,659	1.7	337	0.4
1989	27,934	1,164	4.2	22	0.1	98,571	2,119	2.2	361	0.4
1990	23,821	1,675	7.0	34	0.1	80,446	1,956	2.4	358	0.5
1991	29,409	2,741	9.3	24	0.1	83,240	2,383	2.9	257	0.3
1992[1]	42,523	1,952	4.6	62	0.2	112,037	2,517	2.3	301	0.3
1993[1]	52,623	2,050	3.9	51	0.1	130,616	1,657	1.3	611	0.5
1994[1]	34,361	896	2.6	58	0.2	125,967	999	0.8	600	0.5
1995[1]	19,557	1,310	6.7	27	0.1	60,356	651	1.1	189	0.3
1996	7,246	370	5.1	13	0.2	27,113	254	0.9	82	0.3
1997	5,938	239	4.0	26	0.4	44,024	595	1.4	192	0.4
1998	6,850	337	4.9	20	0.3	30,835	485	1.6	127	0.4
1999	16,279	482	3.2	37	0.2	35,637	339	1.0	71	0.2
2000[2]	5,104	471	9.3	30	0.6	7,477	253	3.4	77	1.0
2001[2]	1,164	15	1.3	0	0.0	4,245	10	0.2	1	0.0
TOTAL	301,767	14,967	5.0	471	0.2	936,980	15,877	1.7	3,564	0.4

	UNCLIPPED STEELHEAD[3]					**CLIPPED STEELHEAD**				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988	7,478	452	6.1	18	0.2					
1989	12,240	536	4.4	13	0.1					
1990[1]	3,894	232	6.0	5	0.1	5,521	818	14.9	25	0.5
1991	2,772	194	7.0	0	0.0	5,502	1,036	18.8	4	0.1
1992[1]	2,837	194	6.8	3	0.1	3,767	487	12.9	2	0.1
1993[1]	4,025	96	2.4	2	0.0	7,456	622	8.3	2	0.0
1994[1]	3,730	102	2.7	2	0.1	3,981	290	7.3	2	0.1
1995[1]	1,240	32	2.6	0	0.0	3,737	397	10.6	5	0.1
1996	1,821	44	2.4	1	0.1	5,075	369	7.3	5	0.1
1997	3,616	35	1.0	7	0.2	9,285	635	6.8	9	0.1
1998	2,587	56	2.2	1	0.0	3,294	208	6.3	5	0.2
1999	2,549	29	1.1	4	0.2	5,647	170	3.0	4	0.1
2000[2]	1,314	104	7.9	0	0.0	1,378	173	12.6	1	0.1
2001[2]	91	0	0.0	0	0.0	25	3	12.0	0	0.0
TOTAL	50,194	2,106	4.2	56	0.1	54,668	5,208	9.5	64	0.1

	COHO					**SOCKEYE**				
DATE	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988	40,776	1,340	3.3	24	0.1	4,588	1,077	23.6	28	0.6
1989	29,747	998	3.4	5	0.0	7,723	1,319	17.1	11	0.1
1990	43,032	2,325	5.4	30	0.1	4,537	1,710	38.1	45	1.0
1991	23,842	1,059	4.4	5	0.0	4,462	1,205	27.1	9	0.2
1992[1]	23,971	1,485	6.2	24	0.1	638	83	13.0	0	0.0
1993[1]	28,243	649	2.3	6	0.0	4,939	803	16.3	16	0.3
1994[1]	22,378	430	1.9	27	0.1	2,965	322	10.9	2	0.1
1995[1]	11,868	258	2.2	16	0.1	2,184	305	14.1	16	0.7
1996	12,689	320	2.5	8	0.1	694	43	6.2	4	0.6
1997	12,346	363	2.9	16	0.1	589	84	14.3	1	0.2
1998	6,272	176	2.8	2	0.0	1,737	299	17.3	6	0.3
1999	8,411	94	1.1	31	0.4	2,118	165	7.4	16	0.7
2000[2]	2,452	101	4.2	22	0.9	223	51	23.0	1	0.4
2001[2]	397	1	0.3	0	0.0	223	51	23.0	1	0.4
TOTAL	266,424	9,599	3.6	216	0.1	37,620	7,517	20.1	156	0.4

[1] Sampling in 1992-1995 was conducted 24 hours per day.
[2] Sampling was conducted 3 times weekly for GBT exams and condition monitoring purposes.
[3] Unclipped and clipped steelhead were not differentiated prior to 1990.

Table C-4. PH1 annual condition subsampling data, 1988-2001, expressed as a percent of total.

YEAR	NO.	INJURY			DISEASE				BIRD	3-19%
	SMPLD	HEAD	OPERC.	BODY	PAR.	COL.	FUN.	BKD	PRED	DESC
Yearling Chinook										
1988	1856	0.27	0.05	0.59	0.05	N/A	0.11	0.00	0.16	4.20
1989	2327	0.39	0.39	1.12	0.21	N/A	0.34	0.17	0.43	8.04
1990	3111	0.10	0.13	0.84	0.13	N/A	0.51	0.23	0.58	9.64
1991	2158	0.42	0.32	0.65	0.00	N/A	0.23	0.23	0.42	5.38
1992	2190	0.41	0.23	0.73	0.27	N/A	0.37	0.87	0.50	6.39
1993	2934	0.00	0.65	3.03	0.55	N/A	0.85	0.00	0.55	14.25
1994	4018	0.00	0.37	1.84	0.20	N/A	0.77	0.00	1.14	9.98
1995	2648	1.44	1.36	4.80	0.98	N/A	0.87	1.13	0.98	14.31
1996	2305	0.52	0.56	1.52	0.22	0.00	0.48	0.43	1.13	12.75
1997	1591	0.19	0.44	1.19	0.06	0.00	0.31	0.13	0.94	9.99
1998	1687	0.41	0.24	0.65	0.18	0.00	1.01	0.24	0.95	13.04
1999	3429	0.55	0.82	0.73	0.17	0.00	0.93	0.90	1.84	14.09
2000	2601	0.77	0.69	0.54	0.12	0.00	1.96	0.85	1.35	13.99
2001	1055	0.008	0.01	0.01	0.01	0	0.04	0.01	0.011	0.06
Unclipped Steelhead										
1988	2148	0.09	0.05	0.28	0.05	N/A	0.61	0.00	0.05	3.17
1989	2626	0.42	0.23	0.42	0.19	N/A	0.30	0.00	0.19	6.28
1990	3468	0.09	0.09	0.43	0.09	N/A	0.40	0.06	0.46	7.73
1991	1967	0.20	0.20	0.36	0.20	N/A	0.15	0.10	0.31	1.83
1992	1883	0.27	0.37	0.32	0.16	N/A	0.64	0.00	0.32	5.47
1993	2227	0.00	0.45	1.93	0.27	N/A	0.90	0.00	0.31	5.34
1994	2725	0.00	0.22	1.10	0.11	N/A	1.10	0.00	0.33	6.68
1995	2574	0.62	0.35	3.11	0.85	N/A	1.09	0.12	0.47	7.58
1996	2720	0.18	0.18	0.55	0.18	0.11	0.37	0.04	1.03	10.22
1997	2347	0.30	0.09	0.60	0.09	0.00	0.30	0.04	0.55	7.93
1998	768	0.65	0.52	0.91	4.56	0.00	0.39	0.00	1.95	10.94
1999	1067	0.28	0.47	0.47	9.75	0.00	0.84	0.00	1.78	9.37
2000	1022	0.88	0.88	0.88	8.71	0.10	0.88	0.00	6.36	13.80
2001	89	0	0.01124	0	0.2	1.97	1.63	2.19	0	0.03
Coho										
1988	1403	0.78	0.29	0.78	1.50	0.50	0.00	0.00	3.85	7.48
1989	2319	0.43	0.73	1.21	3.32	N/A	1.03	0.04	2.50	10.48
1990	1366	0.88	0.73	1.46	0.15	N/A	3.07	0.00	6.15	21.52
1991	1024	0.29	4.39	0.88	0.20	N/A	0.78	0.20	3.81	9.67
1992	735	0.41	2.99	1.09	0.41	N/A	1.22	0.00	4.76	11.02
1993	1669	0.00	1.86	3.18	2.22	N/A	1.44	0.00	0.00	16.12
1994	1595	0.00	3.13	3.64	0.94	N/A	0.56	0.00	8.40	21.63
1995	1278	1.88	3.36	5.71	2.11	N/A	3.05	0.08	8.29	25.67
1996	1789	0.28	3.47	2.12	0.11	0.00	0.78	0.06	10.01	27.56
1997	1978	0.01	0.03	0.02	0.05	0.15	0.40	0.00	6.77	25.28
1998	1960	0.41	0.31	0.36	0.15	0.00	1.12	0.05	0.36	7.60
1999	2643	0.30	0.38	0.19	0.15	0.00	3.67	0.08	0.72	6.36
2000	178	0.56	0.56	1.69	0.56	0.00	2.81	0.00	0.56	5.06
2001	221	0	0.00905	0	0	0	0.01	0	0.005	0.063

YEAR	NO.	INJURY			DISEASE				BIRD	3-19%
	SMPLD	HEAD	OPERC.	BODY	PAR.	COL.	FUN.	BKD	PRED	DESC
Subyearling Chinook										
1988	3451	0.09	0.03	0.67	0.03	N/A	0.09	0.00	0.12	2.98
1989	8481	0.15	0.09	1.29	0.15	N/A	0.05	0.12	0.04	4.55
1990	6929	0.10	0.14	0.64	0.16	N/A	0.07	0.32	0.27	1.93
1991	4404	0.23	0.11	0.43	0.30	N/A	0.05	0.52	0.09	2.45
1992	4422	0.09	0.25	0.34	0.41	N/A	0.05	0.79	0.47	3.55
1993	8343	0.00	0.36	3.12	0.31	N/A	0.08	0.00	0.11	7.76
1994	7149	0.00	0.29	0.92	0.10	N/A	0.10	0.00	0.08	4.00
1995	5230	0.33	0.44	1.97	0.23	N/A	0.13	0.17	0.13	5.35
1996	4080	0.32	0.47	0.69	0.12	0.00	0.17	0.05	0.22	4.56
1997	4893	0.25	0.49	0.76	0.25	0.02	0.16	0.14	0.16	5.89
1998	3324	0.33	0.48	1.08	0.30	0.00	0.39	0.15	0.21	8.33
1999	4513	0.22	0.55	0.69	0.02	0.00	0.20	0.00	0.24	6.16
2000	3483	0.46	0.89	1.09	0.06	0.00	0.49	0.09	0.43	6.89
2001	1017	0	0.00	0.01	0	0	0	0	1E-03	0.04
Clipped Steelhead										
1988	All in Unclipped									
1989										
1990	1042	0.38	0.19	1.44	4.03	N/A	1.25	0.00	2.11	10.08
1991	706	0.85	0.71	1.56	8.22	N/A	0.71	0.00	1.56	2.55
1992	590	0.17	0.17	0.68	5.59	N/A	0.34	0.00	2.20	5.59
1993	1250	0.00	0.24	1.60	6.64	N/A	0.72	0.00	5.84	6.56
1994	1429	0.00	0.49	2.59	8.33	N/A	0.49	0.00	2.80	9.24
1995	419	1.67	1.19	2.86	19.33	N/A	0.24	0.00	3.10	9.79
1996	789	0.25	0.63	0.38	8.11	0.00	0.25	0.00	1.52	9.00
1997	1306	0.61	0.77	1.23	4.59	0.00	0.23	0.00	2.07	6.89
1998	1011	0.69	2.77	2.08	0.30	0.00	1.58	0.00	7.52	25.32
1999	2158	0.32	3.06	0.93	0.42	0.00	1.02	0.00	5.70	19.32
2000	1057	0.95	2.55	1.89	0.47	0.00	0.57	0.00	11.54	20.06
2001	23	0	0.08696	0	0.04348	0	0	0	0.087	0.13043
Sockeye										
1988	686	0.00	0.00	0.00	0.00	N/A	0.00	0.00	0.00	9.62
1989	1397	0.50	0.50	0.36	0.00	N/A	0.07	0.07	0.07	16.11
1990	1425	1.26	0.77	0.49	0.07	N/A	0.14	0.07	0.14	14.88
1991	621	0.97	2.25	0.81	0.00	N/A	0.32	0.00	0.32	11.27
1992	131	0.76	2.29	0.76	0.00	N/A	0.00	0.00	0.00	17.56
1993	940	0.11	2.34	3.09	0.32	N/A	0.43	0.00	0.21	23.83
1994	1047	0.00	1.91	1.43	0.00	N/A	0.29	0.00	0.19	26.65
1995	829	0.97	2.41	1.09	0.00	N/A	0.72	0.00	0.24	23.88
1996	307	0.00	1.30	1.63	0.33	0.00	0.00	0.00	0.00	13.36
1997	215	1.40	2.79	0.47	0.00	0.00	0.00	0.00	0.00	25.58
1998	595	2.02	2.86	0.34	0.00	0.00	1.18	0.00	0.00	26.55
1999	869	1.61	3.45	0.35	0.00	0.00	0.35	0.00	0.12	31.42
2000	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.78
2001	14	0	0	0	0	0	0.07	0	0	0.28571

Table C-5. PH1 mark recapture data, 2001.

Elastomer Tags

Species	Location	Color	Release River	Release Number	Number Recaptured
Yearling Spring	Left	Orange	Yakama River	123,000	2
Yearling	Left	Green	Clearwater R.,	238,000	1
Unknown	Right	Green	Snake R., Yakama R.	226,000	1
				Total Elastomer tags =	**4**

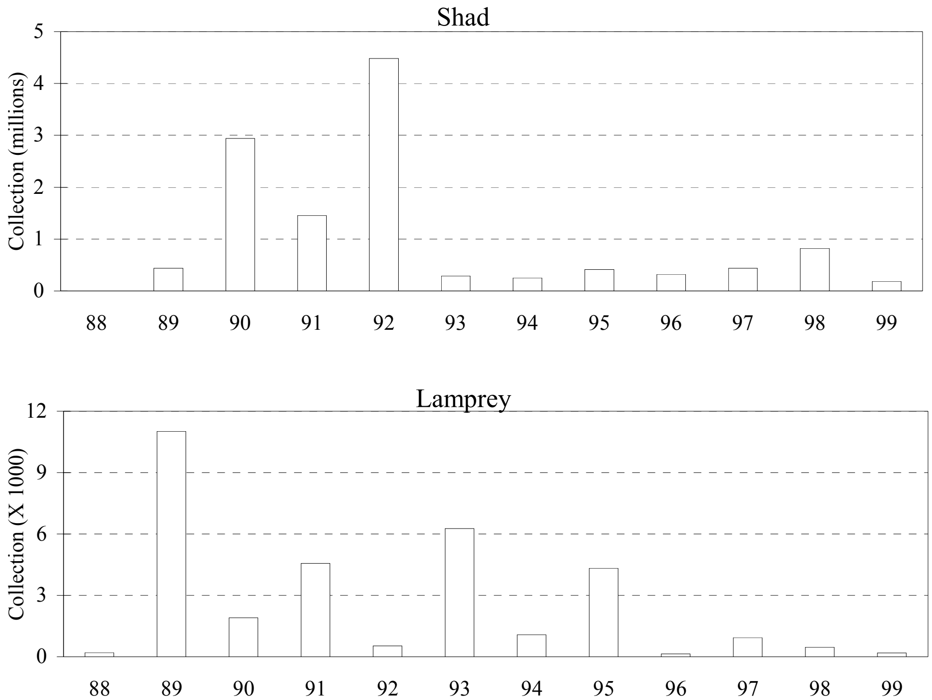


Figure C-5. PH1 annual shad and lamprey collection totals, 1988-1999.

Table C-6. PH1 incidental catch summary using collection estimates, 1988 - 2001.

Year	American Shad		Pacific Lamprey		Stickleback	Peamouth	Northern	Redside	S-Mouth	Sculpin	Mountain
	Juvenile	Adult	Juvenile	Adult			Squawfish	Shiner	Bass	Species	Whitefish
1988	2,361	17	204	37	1,017	754	243	264	228	177	33
1989	435,653	39	34,756	63	2,473	1,413	698	384	5	193	34
1990	2,939,363	0	1,909	0	4,527	224	520	56	88	47	58
1991	1,454,524	8	4,567	4	1,862	849	889	224	31	12	121
1992	4,479,820	46	531	86	6,581	1,053	672	67	162	136	41
1993	288,463	148	6,269	78	6,583	1,603	264	377	251	268	75
1994	252,474	85	1,074	47	78,799	4,669	311	269	122	56	65
1995	414,487	1,130	4,335	213	5,931	2,227	979	677	567	233	665
1996	318,190	104	146	60	88	823	21	259	59	60	73
1997	437,715	1,097	945	48	175	1,175	50	128	805	87	113
1998	820,864	64	464	26	81	899	124	39	52	4	84
1999	187,300	75	189	23	91	385	47	85	43	21	10
2000[1]	493	5	7	3	8	178	3	0	0	1	0
2001[1]	1	0	0	5	6	1	2	0	0	43	0

[1] Beginning in 2000, sampling effort was reduced to condition monitoring, no collection estimates were calculated.

APPENDIX C

Table C-7. PH1 gas bubble trauma (GBT) examination summary, 2001.

			Incidence of Gas Bubble Trauma symptoms						
			% of monthly sample				Smolt Affected		Monthly %
Month	**Species**	**Sample Size**	Lateral line	Eyes	unpaired fins ranks 1 and 2[1]	unpaired fins ranks 3 and 4[1]	Number	Percent	of Season Totals
April	Spring Chinook	491	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
	Unclipped Steelhead	11	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
	Clipped Steelhead	3	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
Monthly Total		505	0.00%	0.00%	0.00%	0.00%	0	0.00%	**0.00%**
May	Spring Chinook	364	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
	Unclipped Steelhead	70	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
	Clipped Steelhead	54	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
Monthly Total		488	0.00%	0.00%	0.00%	0.00%	0	0.00%	**0.00%**
June	Spring Chinook	99	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
	Fall Chinook	390	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
	Unclipped Steelhead	6	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
	Clipped Steelhead	11	0.00%	0.00%	0.00%	0.00%	0	0.00%	0.00%
Monthly Total		407	0.00%	0.00%	0.00%	0.00%	0	0.00%	**0.00%**
July	Fall Chinook	847							
Monthly Total		847	0.12%	0.00%	0.00%	0.00%	1	0.12%	**100.00%**
August	Fall Chinook	900							
Monthly Total		900	0.00%	0.00%	0.00%	0.00%	0	0.00%	**0.00%**
Season Totals	Spring Chinook	855	0.00%	0.00%	0.00%	0.00%	0	0.00%	
	Fall Chinook	2137	0.05%	0.00%	0.00%	0.00%	1	0.05%	
	Unclipped Steelhead	87	0.00%	0.00%	0.00%	0.00%	0	0.00%	
	Clipped Steelhead	68	0.00%	0.00%	0.00%	0.00%	0	0.00%	
Season Total		3147	0.03%	0.00%	0.00%	0.00%	**1**	**0.03%**	
Total number of symptoms in each location			1	0	0	0	1		
% of symptoms in each location			100.0%	0.0%	0.0%	0.0%			

[1] GBT symptoms were ranked as follows: 0 = 0% coverage, 1 = 1-5% coverage, 2 = 6-25% coverage, 3 = 26-50% coverage, and 4 = greater than 50% coverage.

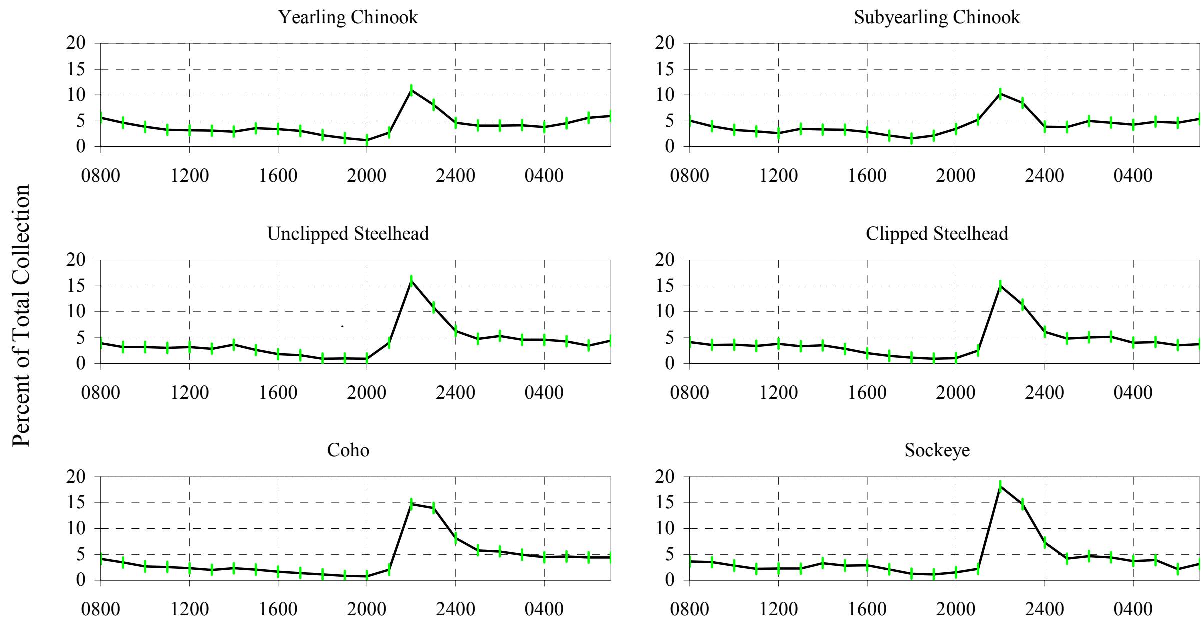


Figure C-6. PH1 average diel passage, 1992-1995, with standard deviation.

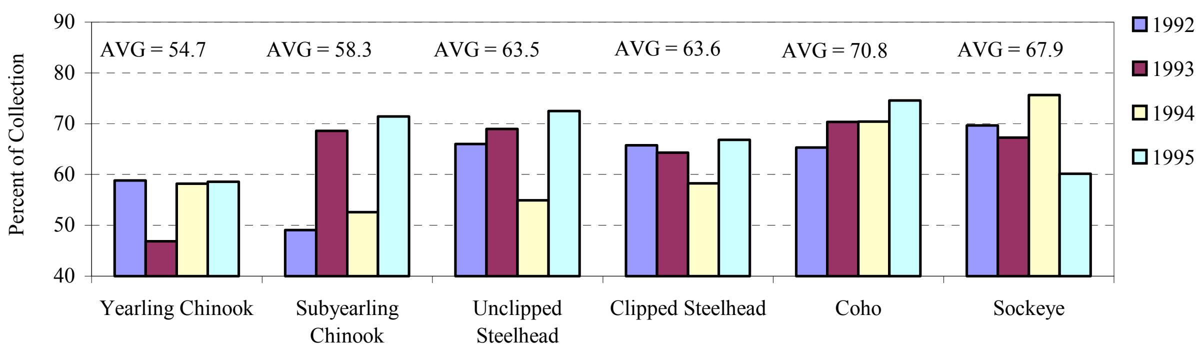


Figure C-7. PH1 percent night passage (1800-0600), 1992-1995, by species.

Table C-8. PH1 percent night passage (1800-0600) for 1992-95.

YEAR	Yearling Chinook	Subyearling Chinook	Unclipped Steelhead	Clipped Steelhead	Coho	Sockeye	All Species Combined
1992	58.8	49.1	66.0	65.7	65.3	69.7	53.4
1993	46.9	68.6	68.9	64.3	70.4	67.3	62.9
1994	58.2	52.6	54.9	58.2	70.4	75.6	56.3
1995	58.6	71.4	72.5	66.8	74.6	60.2	68.1
AVG	54.7	58.3	63.5	63.6	70.8	67.9	59.8
MIN	46.9	49.1	54.9	58.2	65.3	60.2	53.4
MAX	58.8	71.4	72.5	66.8	74.6	75.6	68.1

Table C-9. PH1 percent of total passage per hour, 1992-1995.

Yearling Chinook

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	5.8	4.5	3.8	3.2	3.1	3.0	2.9	3.6	3.4	3.1	2.3	1.7	1.2	2.5	10.5	7.8	4.5	4.1	4.0	4.1	3.8	4.7	5.8	6.4
MIN	4.4	3.4	3.1	2.7	2.5	2.4	2.4	2.8	3.1	2.5	1.9	1.4	1.0	1.5	7.9	6.6	3.5	3.5	3.1	3.5	3.4	3.6	4.3	3.8
MAX	6.7	5.4	4.8	4.0	4.0	3.6	3.6	4.3	3.8	3.9	2.6	2.2	1.5	3.9	12.9	10.5	5.2	4.7	5.7	4.5	4.3	6.2	6.8	7.7

Subyearling Chinook

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	5.2	4.3	3.4	3.0	2.7	3.3	3.5	3.6	3.0	2.1	1.6	1.8	3.1	5.0	10.1	8.1	3.6	3.5	4.7	4.6	4.2	4.8	4.6	6.0
MIN	3.2	2.7	2.2	2.3	2.1	2.0	1.9	2.1	1.8	1.6	1.3	0.9	0.6	2.4	7.4	6.1	3.1	2.6	3.1	3.9	4.0	4.5	4.0	3.0
MAX	6.5	5.1	4.1	4.0	3.3	5.1	4.4	4.5	4.1	3.0	1.8	4.8	7.7	10.2	14.0	11.9	4.6	5.0	8.7	5.7	4.7	5.2	6.0	7.1

Unclipped Steelhead

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	4.4	3.4	3.3	3.1	3.3	3.1	3.7	2.8	2.0	1.7	1.0	0.9	0.9	3.3	14.8	10.0	6.0	4.9	5.1	4.5	4.7	4.5	3.8	4.8
MIN	2.2	2.0	2.4	2.1	2.0	1.9	2.7	2.2	1.1	1.5	0.7	0.7	0.7	2.6	11.9	8.1	5.5	4.1	3.0	2.8	3.0	2.8	2.4	2.8
MAX	5.5	4.7	4.4	3.7	4.1	4.4	4.4	3.3	2.4	1.8	1.2	1.3	1.4	6.5	19.4	15.3	6.8	6.2	7.0	6.4	6.7	6.5	5.4	5.5

Clipped Steelhead

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	4.2	3.7	3.6	3.3	3.8	3.2	3.2	2.8	2.1	1.6	1.1	0.9	1.0	2.2	14.0	9.4	5.8	5.1	5.7	5.9	4.8	5.0	3.8	3.9
MIN	3.5	2.8	3.1	2.5	3.2	2.6	2.3	2.3	1.3	1.3	1.0	0.8	0.9	1.5	11.0	6.5	5.5	4.3	3.6	3.9	2.7	3.0	2.4	2.4
MAX	4.6	4.4	4.7	4.4	4.0	3.9	4.3	3.7	2.6	1.8	1.3	1.1	1.2	3.4	20.8	16.1	6.9	5.7	6.6	7.1	6.4	7.1	4.6	4.6

Coho

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	3.9	3.3	2.5	2.3	2.2	2.0	2.3	2.1	1.6	1.3	1.1	0.8	0.8	1.8	14.5	13.8	8.0	6.0	5.8	5.2	4.8	5.0	4.4	4.6
MIN	2.7	2.1	2.1	2.1	1.9	1.7	2.1	1.7	1.2	0.8	0.9	0.5	0.4	0.3	11.1	8.1	7.2	4.8	3.5	3.2	2.7	2.7	2.9	2.7
MAX	5.5	4.9	3.6	3.4	2.9	2.2	2.6	2.4	2.0	2.0	1.7	1.2	1.1	3.9	18.1	18.5	9.2	6.7	7.4	6.4	6.1	6.1	7.4	5.8

Sockeye

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	3.9	2.8	2.5	2.5	2.1	2.1	3.1	2.9	2.7	2.4	1.6	1.5	1.7	2.7	17.3	10.6	5.8	4.7	5.8	5.2	4.7	4.8	3.2	3.5
MIN	1.7	1.6	1.9	1.6	1.3	1.3	2.5	1.6	2.1	0.4	0.4	0.1	0.1	0.1	14.4	5.1	3.3	3.1	2.9	2.9	1.8	1.9	0.4	2.2
MAX	5.0	5.8	4.5	2.8	3.5	3.9	4.9	5.4	4.7	4.6	2.5	2.7	3.4	5.4	21.0	26.1	11.5	5.4	7.0	6.1	5.5	5.7	4.3	3.9

All species combined

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
AVG	5.1	4.1	3.3	2.9	2.7	3.0	3.2	3.3	2.9	2.2	1.6	1.6	2.3	3.8	11.2	9.0	4.6	4.1	4.8	4.7	4.2	4.8	4.7	5.7
MIN	3.3	2.7	2.5	2.5	2.4	2.3	2.3	2.8	2.3	2.1	1.5	0.9	0.8	3.0	9.1	6.6	4.3	3.2	3.3	4.3	3.7	4.1	3.8	3.4
MAX	6.0	4.8	4.0	3.8	3.2	4.2	3.7	3.8	3.5	2.7	1.8	3.0	4.1	5.6	14.8	10.0	5.3	5.0	7.4	5.3	4.6	5.1	6.1	6.8

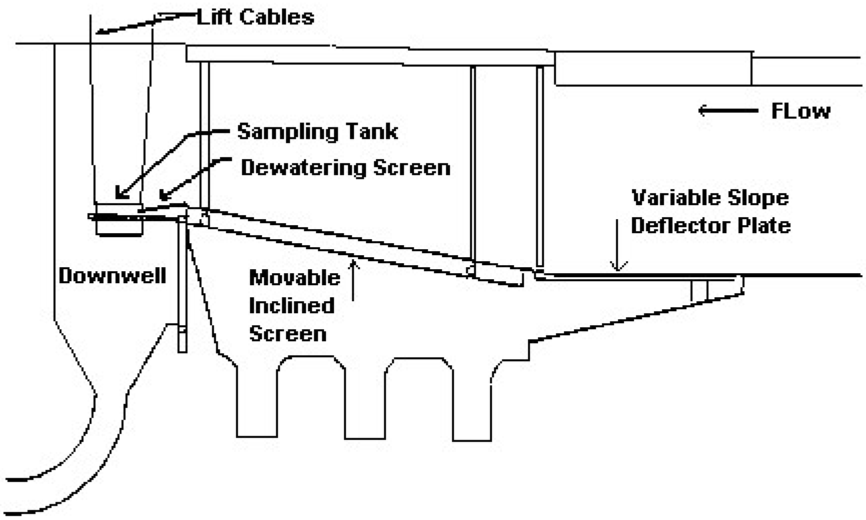


Figure C-8. PH1 inclined screen sampling system, 1986-2001.

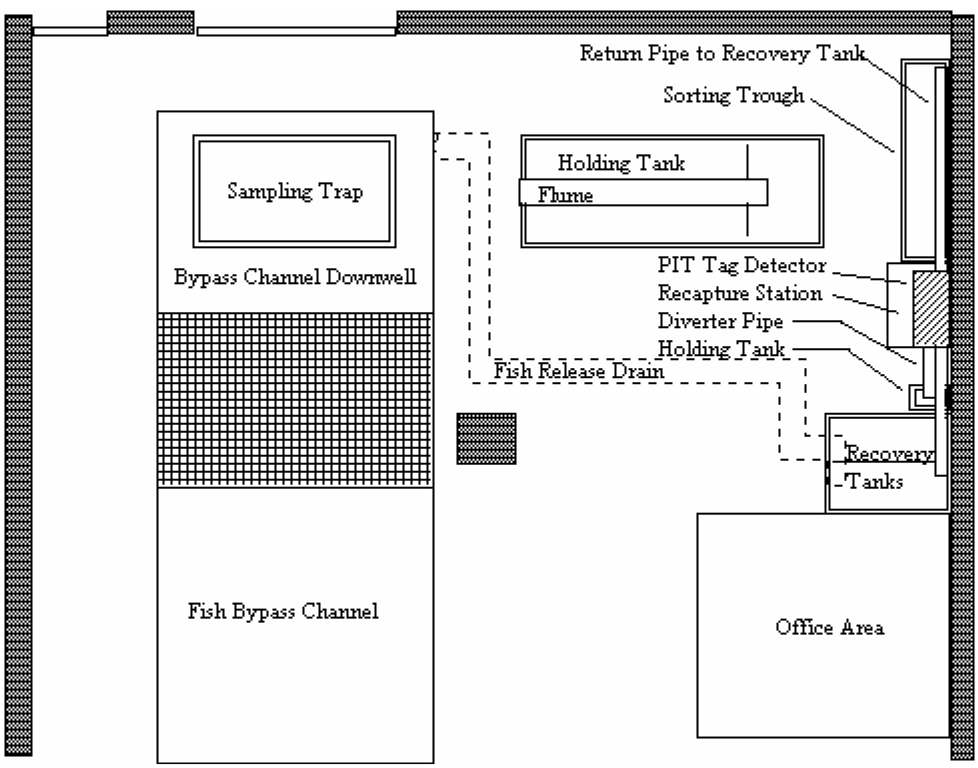


Figure C-9. PH1 laboratory layout, used through 1998.

APPENDIX C

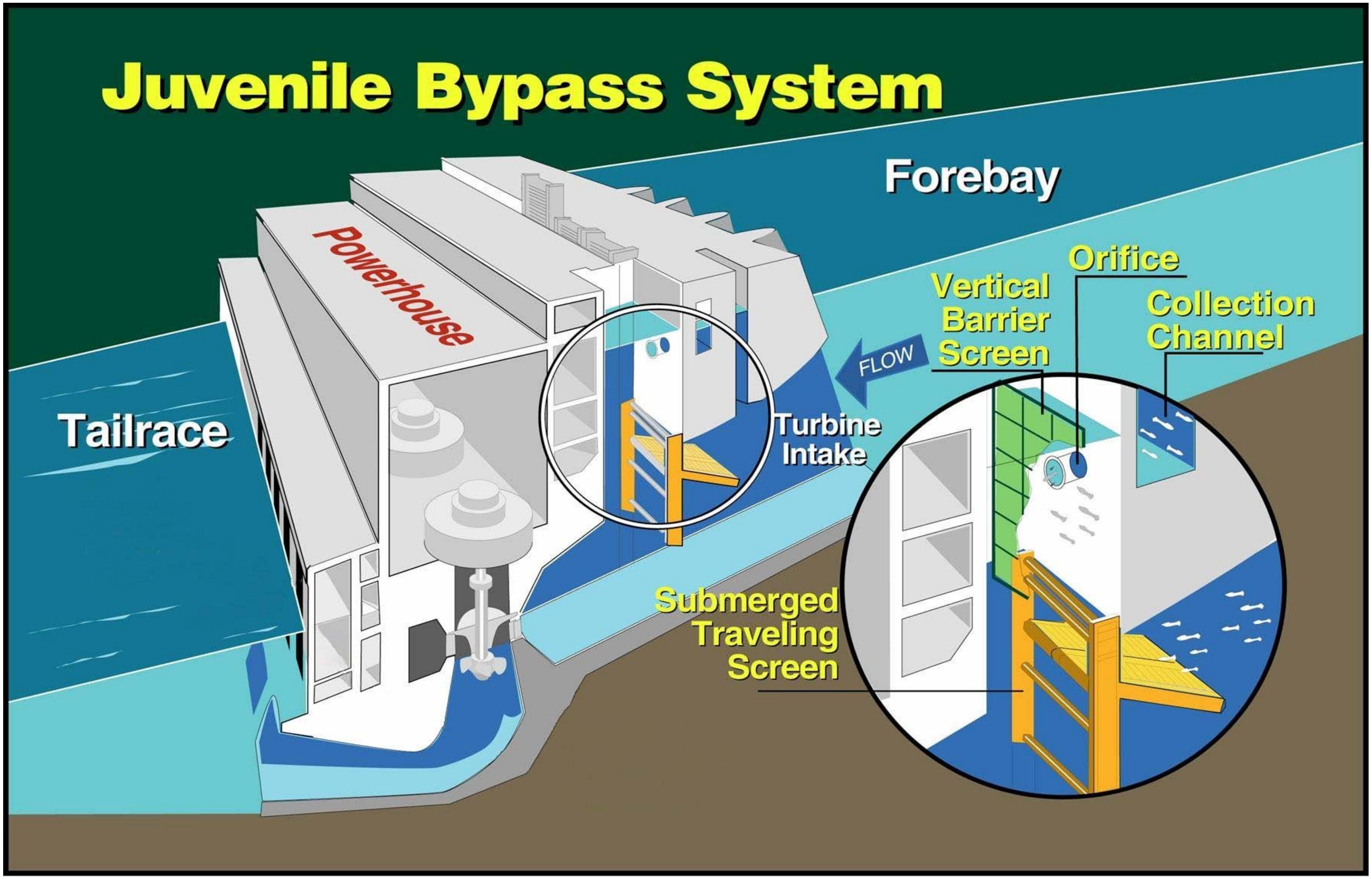


Figure C-10. Typical Submerged Traveling Screen Bypass System in use at Bonneville and John Day Dams.